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SELECTING THE WRONG PROFESSION.

The familiar recommendation that one should endeavor to know one's self is advice of a very comprehensive nature. While it is not necessary here to attempt to define self-knowledge completely, it is worth while, perhaps, to emphasize the necessity of this sort of knowledge along business or professional lines.

The man who does not, in early life, become intimately conscious of his own talents and inclinations and limitations in the matter of vocational effort, usually attains but a moderate measure of success in whatever vocation he happens to adopt, or else fails in it altogether. The homely saying that some men think themselves called to preach when they are actually called to plough, contains more of truth than of humor, if applied to vocations in general. There has been many a second-rate lawyer or teacher highly successful as an engineer or mechanic or merchant. The trouble was that he did not discover himself in time to profit by the discovery, if he ever made the discovery at all. Not a few men who as electricians or supervising engineers could be relatively happy and prosperous, permit themselves to continue in the electrical contracting business when contracting will probably forever remain to them as devoid of real profits as the sphinx is of a sense of humor.

Oftener than not the one special weakness of men of the type just mentioned is a lack of what may be called the business instinct. Electrical contracting is a business as well as a vocation, and business sagacity is quite as essential on the part of the contractor as is professional or technical knowledge.

It is not meant, of course, that proficiency in business methods can not be acquired through experience and study. A man who has the average aptitude along such lines may acquire it thus. But there are men who cannot. They are so constituted that their judgment in business matters is usually wrong, and the tedious detail of business routine is so burdensome to them that they usually can be counted upon to neglect it, whatever the result. Such a man had better not try to manage a contracting business.

What to do with men of this type, and how to reach all contractors who need education in business and are susceptible to it, is perhaps the hardest problem in the contracting field now. National and local associations are doing a great deal in the matter, but the real work has hardly been begun.

THE CONVENTION OF THE ILLUMINATING ENGINEERING SOCIETY.

Last week the sixth annual convention of the Illuminating Engineering Society was held at Niagara Falls, Canada, this being the first excursion of the society to foreign soil. The resulting inconvenience in getting baggage and demonstration apparatus passed through the custom house was fully offset by the delightful location of the Clifton Hotel, at which the convention was held. Except for the Baltimore convention, which holds a unique position in the annals of the Society, this was the first time that a convention has been held except in those cities which are the centers of geographical sections of the Society. Although some apprehension had been felt regarding the success of the convention under such circumstances, this proved to be groundless, as the convention was a success from every point of view. While the registration was not so great as at other recent conventions, it was, nevertheless, quite satisfactory. The circumstances surrounding the meeting at such a place result in a larger attendance at the sessions in proportion to the registration. A full report of the convention will be found in this issue.

The general quality of the papers presented was high and the material which they contained of much importance to those interested in the various aspects of illumination. Nearly all of the papers were the result of prolonged study and investigation, although as usual a few cropped out which had been hastily put together and evidently had not received the study and criticism with which every subject should meet before presentation at such a convention.

The banquet of the society held on Tuesday evening was a most sociable affair, and good fellowship and good-natured fun reigned supreme. The ladies attended in considerable numbers and took part in the responses to the toasts. Mr. Arthur Williams, who acted as toastmaster, amply proved his ability to carry out that role, and very gracefully introduced the various officers of the Society and others who were called upon for informal responses. Not only in respect to this event, but in regard to the other entertainment features, the Committee on Arrangements and the Entertainment Committee, of which Mr. Norman Macbeth and Mr. J. E. Montague were respectively chairmen, have every reason to feel satisfied with their efforts, which met with the approbation of those present.

The most optimistic tone prevailed in the meeting which was held to consider the general welfare of the Society, especially with reference to questions of finance. While a disposition was shown on the part of a few to differentiate the membership into two or more classes, the proposition did not seem popular, and there is little likelihood of this change being made. Several propositions for increasing the income of the Society were considered and these taken in connection with the curtailment of expenses along lines which will not interfere with the progress or activity of the Society, such as the elimination of stenographic reports, gave good promise of meeting the exigencies of the case. It seems quite evident that the membership of the Society among the smaller central stations is not nearly so general as it should be, and no doubt a well conducted campaign in this direction would not only widely increase the influence of the Society and help to propagate the principles of good lighting which it is trying to introduce, but would also tend to place the Society in a more stable and prosperous condition.

THE ILLUMINATION PRIMER.

The pamphlet which has just been issued by the Illuminating Engineering Society entitled, "Light, Its Use and Misuse," and commonly referred to as the "Illumination Primer," is a most valuable contribution to the literature upon this subject and to the propaganda having for its object the general appreciation of the essentials of good lighting and their commercial application, and a knowledge of the evils which may result from the improper use of artificial light. While the pamphlet is small, comprising only 20 pages, it is written in simple English diction which may be read by the man in the street without technical or scientific knowledge as a preparation, and it may be repeated that it is a valuable contribution to the literature of the subject. Its influence is likely to be wide and will be mainly governed by the wideness of its distribution among those who take any interest in the subject. The Society should, and no doubt will, make a determined effort to place it in the hands not only of everyone who is commercially interested in the problems of artificial lighting, but also in the hands of school teachers, architects, oculists and the various other large classes of persons who, through the design, control or use of artificial lighting arrangements, or through their opportunities to instruct children or clients, exert a wide influence, and may thus disseminate the proper principles which should govern the application of either natural or artificial light, both indoors and outdoors.

The Illumination Primer presents in concise and yet easily understood language the essential points for the proper use of light and the criteria by which the sufficiency of any lighting installation may be roughly judged, both as to its general suitability and the presence of radical defects. Illustrations of good and bad lighting serve to emphasize the statements made and emphasis is placed upon the desirability of avoiding glare.

It is to be hoped not only that the Society will be successful in procuring a wide circulation for this publication, but that it will continue in similar efforts to bring to the attention of the general public, and especially to those who should properly be informed upon such subjects, the proper consideration of questions concerned with good illumination, both

artificial and by daylight. There are many directions in which such activity on the part of the Society might accomplish good work. The recent appointment of a committee to co-operate with other societies is a step, and the efforts of this committee already promise fruitful results. While the primary object of such a society is the benefit of its own members, it is through such work in developing a proper public opinion and educating the laity that it will find the greatest justification for its existence.

The members of the committee who have prepared the primer, Messrs. L. B. Marks, chairman; J. R. Cravath and Dr. Louis Bell, have given considerable time and attention to a work which has not proved so easy as might be anticipated. The preparation of such a manual for public distribution is a much harder task than it would be if the matter were only to come before members of the Society. The committee has done good service, not only to the society, but to the public. Attention may well be called in this connection to the choice of paper which has been made for the publication. The paper used in the primer has a very mat surface, almost devoid of specular reflection, so that the annoying glare which is commonly experienced in reading from calendered paper is entirely absent. Such paper can be obtained of good quality, so that it combines with this property a capacity for taking good impressions from half-tone cuts. Such paper, which should be more largely used for reading matter, especially in weekly and monthly journals and magazines, can be obtained at prices which compare favorably with calendered paper, so that there is little excuse for making a selection which is bad in this respect. The society has a Committee on Glare from Reflecting Surfaces, of which Mr. M. Luckiesh is chairman, which is undertaking some pioneer work in bringing this matter to the attention of publishers and others who have it in their power to bring about an important reform in current practice.

"COBWEBS OF THE SHOPS."

"What is the matter?" called out the proprietor of a small jobbing shop in the manufacturing district of Chicago. He had seen a stranger enter, glance around sharply and start to leave.

"Guess I came too early. I see your machinery is not connected up yet."

Whereat the up-to-date shop manager smiled, for his machinery was all "connected up," though not by a conspicuous network of belting. Indeed, part of the machinery was actually running at the time, but doing it so quietly as to mislead the visitor. Like thousands of others, the latter had been trained to associate the thought of shop activity with the flopping of leather cobwebs, which carry dust, which always interfere with light and often with the economical handling of materials, and which require power for driving them even if the machines to which they lead are not being used.

Few factory managers or shop owners realize in how many ways the old-fashioned belt drives interfere with the economical use of power and with obtaining the maximum output from a given set of machines. Indeed, most users have grown so accustomed to the leather cobwebs of the shop that they are quite unconscious of the hindrances implied by the same. To rouse them from this lethargy they need to see pictures, or better still samples, of shops in which the introduction of direct-connected electric motors has driven out the maze of belts. The power solicitor who has with him photographs of the same shop before and after eliminating the surplus of belting is carrying good ammunition and if he can occasionally refer to the belts as the "cobwebs of the shops," the suggestiveness of the phrase may make it linger in the memory of his listeners. When such a term is once impressed upon a prospect, the latter will find it difficult to face a maze of flopping belts without thinking of the appropriate characterization and his doing this will make it much easier for the power or equipment solicitor to secure the desired contract.

A HINT ABOUT REGULATION.

The commercial value of good regulation is not always appreciated by the public, and there is now an opportunity as the winter lighting peak approaches to drive the lesson home in more senses than one. The maintenance of even voltage at the lamp terminals is one of the chief responsibilities of the efficiently managed central station, and there is no question that it pays well to spend good money to secure this. Here is where many an isolated plant fails to satisfy its owner and to poor regulation has been due the abandonment of many thousands of dollars' worth of equipment. In emphasizing this point we are not holding a brief for either the central station or the isolated plant, for each has its legitimate sphere, to be determined by a thorough engineering study in each case. But it should again be emphasized that voltage fluctuations on local lighting circuits must be cut down at least sufficiently to be invisible to the eye if the installation is to continue as a success, judged by present standards. These lines are penned in the writing room of one of America's newest and most costly hotels, where no money has been spared to install efficient lamps, beautiful shades, and reflectors throwing the luminous flux over the left shoulder and upon the glass-topped curtained tables without glare or shadow, and yet the whole effect is marred by the fluctuation of voltage at the lamps, due to the operation of large motors upon the same generator that is furnishing the lighting service. The moral is obvious and unless suitable regulating devices can be installed by the owners, good service, which insures satisfactory lamp life in such cases, besides pleased patronage, can only be obtained by the separation of motor and lamp loads.

Boston Vehicle Club.

The first meeting of the Electric Vehicle Club of Boston, Mass., for the season of 1912-13 was held on September 18 at the Thorndike Hotel in that city. Day Baker, of the General Vehicle Company, permanent chairman of the club, outlined the history of the organization and told of its achievements in extending electric-vehicle propaganda in Boston and vicinity. He said the object of the club is to teach the public that there are certain classes of traffic which can be handled to best advantage with the electric truck. Among things the club has done he enumerated the placing of illuminated signs, advertising the electric vehicle, the electric-vehicle parades that have been held, the use of moving-picture films showing commercial and passenger cars in operation, the advertising campaigns conducted in the daily newspapers, and the weekly luncheons held at the Edison Building throughout the year. Mr. Baker also spoke of the research work on the comparative cost of transportation made by Professor Jackson of the Massachusetts Institute of Technology, made possible through a fund provided by C. L. Edgar, president of the Boston Edison Company.

E. S. Mansfield, vice-president of the club, spoke next, telling of the reduction in the price of current for charging cars, soon to be made public, that has been made by the Boston Edison Company. He stated that gasoline at 12 cents per gallon is recognized as being equivalent to electric current at 4 cents per kilowatt-hour. Mr. Mansfield stated that more space is to be devoted to electric vehicles, at the forthcoming Electric Show in this city, than any previous exhibition of electrics has occupied. A model garage, at the Show, will occupy 6,000 square feet. The process of charging will be shown. He stated that many delegates are expected at the Electric Vehicle Convention to be held October 8 and 9, and that thirteen papers on subjects relating to the electric vehicle are to be given. Mr. Mansfield stated that there are now in Massachusetts 156 passenger electric cars and 56 commercial vehicles. Since April 1 of this year 33 ne passenger cars and 27 trucks have been introduced into this territory.

L. D. Gibbs said the cost of getting the show ready to open amounted to $200,000 and that two years have been spent in the preparation. He expressed his gratification that the central stations of New England generally are coöperating heartily. The associations of Maine, New Hampshire and Vermont have each taken two sections. Special rates and excursion trains will bring people to Boston from all New England.

Frank J. Stone reported for the committee appointed to arrange for the future of the club. He recommended $5.00 as a membership fee and a luncheon every two weeks.

Methods of entertaining delegates and other visitors during the convention were discussed.

Mr. Weatherbee of the Detroit Electric Company, a newcomer to Boston, was welcomed.

A. P. Bouguardez, of the General Vehicle Company, New York, praised the spirit of the club and said he wished such an organization existed in New York. He believed in the principle of coöperation among electric-vehicle dealers.

Marconi Extension.

The Marconi Wireless Telegraph Company has secured 1,750 acres at Bolinas and Tomales Bay, about ten miles from San Francisco, for two wireless stations on which will be erected transmitting and receiving mechanism of 500 kilowatts capacity. The stations will be operated simultaneously or in duplex. The total expenditures for land and stations will be $500,000.

At both transmitting and receiving stations will be twelve steel towers 350 feet high in addition to operating houses and power generating plants. When completed the San Francisco stations will communicate direct with a station to be erected at Manila, carrying messages almost 7,000 miles.

The Marconi company has acquired land for two similar wireless stations at Honolulu and structural work has already begun on the island stations.

When the San Francisco and Honolulu stations are completed there will be constant communication by wireless between these two widely separated points night and day.

The Honolulu station is the connecting link of the Marconi wireless globe girdling scheme. Messages will then be possible from San Francisco to Honolulu, to Manila, Singapore and Bangalore, to Aden, thence through Egypt to London and New York.

Byllesby Luncheon Club Holds Field Day.

The first outing and field day of the Byllesby Luncheon Club, which was held at the Wanderers Club grounds, September 18, was voted an unqualified success by the 77 members who attended. The major portion of the day was given over to baseball games, tennis matches and various other athletic events, prizes being awarded the winners. A dinner was held in the evening and an enjoyable musical program concluded the day's entertainment. The affair was arranged and conducted by an Outing Committee composed of A. H. Sayce, R. A. Wortman and W. B. McKenna, all of the Chicago office of H. M. Byllesby & Company.

Power Plant on Susquehanna.

All the residents of the village of Conowingo (Md.), on the Cecil shore of the Susquehanna River, have been notified to vacate their dwellings. This is the first step in the construction of a second dam across the Susquehanna River and a plant to generate electricity by the Susquehanna Power Company. It is only a question of time before the village will rest at the bottom of a huge dammed lake.

The construction will cost about $10,000,000. While the Susquehanna River Company is a corporation separate from the McCall's Ferry Company, which supplies a great part of the electricity distributed by the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., the two companies are closely related through identity of capitalists who have largely invested in both.

The new dam will be erected just below the new bridge which crosses the Susquehanna River at Conowingo.

Financiers and engineers who have watched the plans of the Susquehanna Power Company declare that one of its chief backers is the Pennsylvania Railroad Company, which, it is generally understood, has been seeking electrical power with which to operate its trains through Baltimore, including the two tunnels. Practical railroad men declare that the Philadelphia, Baltimore & Washington Railroad Company, which is the local name for the Pennsylvania Railroad Company, has reached the limit of capacity of the tunnels. The only relief is the construction of two additional and parallel tunnels, which are said to be practically impossible, or the abolition of smoking locomotives by the substitution of electric motors.

It is generally accepted that the new company will work in unison with the McCall's Ferry Company. In fact, the McCall's Ferry Company will encourage the building of the new dam and new plant as supplemental to its own.

Telephone Development.

The current issue of the New York *Telephone Review* reports new appropriations to the amount of over $508,000 out of a total budget of approximately $16,000,000 for the year 1912 for the extension and improvement of the plant facilities of the New York Telephone Company in thirteen communities in the company's territory. Other work previously provided for brings the actual expenditures at present into the millions.

In every part of the territory there is construction and reconstruction work going on practically all the time. Thus the company extends and improves its service under one comprehensive system.

V. R. Lansingh.

Probably no phase of the utilization of electrical energy as a beneficent agent in the life of the people, both in the home and in every industrial occupation, has received so much attention during recent years as the application of scientific principles with regard to the use of electric light sources. It was only a few years ago when the application of electric lamps for the illumination of interiors particularly was a matter of mere guesswork and haphazard installation. Due to the assiduous effort of a few broad-minded men the science of illuminating engineering suddenly sprang into a position of international importance, and the teachings of these men formed the groundwork for a further study which has resulted in the quickening of enterprise, the search for new information, and a revolution in the utilization of illuminating units and their accessory fixtures and glassware.

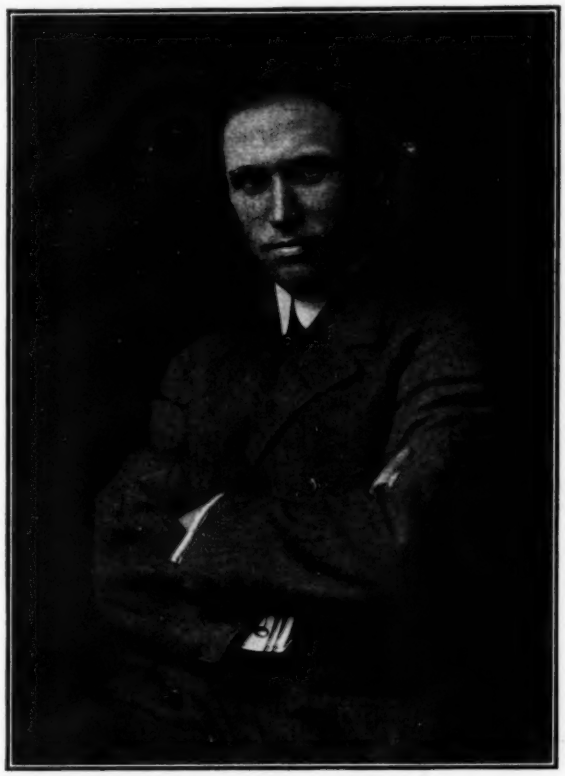
One of the pioneers in the development of the scientific principles of electric illumination and a most prolific contributor to our knowledge of the art and application of this study is the subject of this sketch, Van Rensselaer Lansingh.

Mr. Lansingh received his early education in the public schools of New York City, graduating from high school in 1888, attending the College of the City of New York from 1888 to 1891. He entered the University of Chicago in October, 1892, and was graduated in January, 1896. He attended the Massachusetts Institute of Technology from February, 1896, to June, 1898, receiving the degree of S. B. in Electrical Engineering. During the summer of 1898 he enlisted in the Second United States Volunteer Engineers in the Spanish-American war. In February, 1899, he joined the testing department of the Western Electric Company, going into the engineering department of this company the following month.

In July, 1900, he formed the V. R. Lansingh Company in New York, agents for Holophane globes and reflectors, and in September, 1904, became general manager and chief engineer of the Holophane Company with headquarters in New York City, and this position he holds today with the merging of the company into the Nelite Works of General Electric Company with headquarters at Cleveland.

In addition to his work as an illuminating engineer for his company and as a contributor to the proceedings of the Illuminating Engineering Society and the technical press of this and other countries, Mr. Lansingh is the author, with J. R. Cravath, of "Practical Illumination," which is used as a text book in many educational institutions teaching this subject.

He was one of the founders of the Illuminating Engineering Society, was elected secretary in 1906, and has since filled the positions of treasurer, vice-president and president, the convention of the Society which was held last week at Niagara Falls, Canada, being very successfully conducted with Mr. Lansingh as its able presiding officer.



V. R. Lansingh,
President of the Illuminating Engineering Society.

Fall Meeting of Electrical Supply Jobbers' Association.

The fall meeting of the Electrical Supply Jobbers' Association will be held at Hot Springs, Va., November 13, 14 and 15. Plans are now being made to make this meeting one of special importance and interest to its members. The entertainment features will be well looked after, and it is expected that the golf tournament will bring out a good contingent who will enjoy the opportunity of playing on the celebrated links of Hot Springs.

Illumination Discussed at Louisville.

An interesting discussion of up-to-date illumination was enjoyed by the Engineers' and Architects' Club, of Louisville, Ky., at the September meeting held in the Norton Building last week. E. B. Rowe, of the engineering staff of the Nelite Works, Cleveland, O.; G. H. Maynard, of Washington, D. C., and W. C. Trittipo, of Cleveland, led the round-table talks.

The features which the Washington engineer brought out were those of the softened, artistic illumination of the national capital as compared with the obtrusive glare of some electric installations. "The city beautiful," Mr. Rowe asserted, "is impossible without correct illumination." Using lantern slides and diagrams, the engineers demonstrated the advance of the art of lighting from the candle to the most up-to-date searchlight. The unintelligent use of light was condemned as being responsible for much of the defective eyesight apparent among American school children today. The saw-tooth roof and prism glass were commended as aids in the proper utilization of daylight. Show-window lighting in Louisville, much of which has been done by engineers of the Louisville Lighting Company and the Kentucky Electric Company, came in for approbation. It was asserted that some examples of illuminated windows in various classes of trade in Louisville would compare favorably with any to be found in the country.

Unique Advertising for the New York Electrical Show.

The Electrical Show Company, conducting the New York Electrical Show, which will be held at the new Grand Central Palace, New York City, from October 9 to 19, is distributing a series of miniature posters in color. These are the work of the celebrated cartoonist, F. G. Cooper, and are being distributed prominently in New York as a part of the program of the New York Edison Company.

These original poster designs illustrate the different phases of the application of electrical energy, for instance, electric heating, motor service, lighting, and for the propulsion of electric vehicles, and commemorate, also, the celebration of thirty years of Edison service in New York City.

Power House Accident in Milwaukee.

An accident to the transformers in the Commerce Street power plant of The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., on September 13, 1912, resulted in the temporary interruption of service on the company's alternating-current lines. The accident occurred at 11:45 a. m. The work of restoring the service was started as quickly as possible and was prosecuted so vigorously that within 20 minutes power was on the railway lines for the operation of cars and city bridges. Within three hours service was restored on a part of the alternating-current lines, and by 6:30 p. m. service was restored over the entire alternating-current system. There was no interruption of service in the central direct-current district as the company made good use of its large storage battery emergency equipment. The possibility of such an accident had been foreseen and the company had nearly completed changes in the switchboard involving the expenditure of about $80,000, which, if the work had been completed, would have prevented the accident. In a paid newspaper advertisement 9 inches by 11 inches high the company on September 14, 1912, expressed its regret at the inconvenience to which some of its customers were put by the accident.

Copper Imports and Exports for Fiscal Year.

The Bureau of Statistics, Washington, D. C., has compiled the imports and exports of crude and manufactured copper to and from the United States for the fiscal year ended June 30, 1912. These figures, compared with the data of a year ago, are as follows:

IMPORTS.

Kind.	1911	1912
Ore, matte and regulus	$ 7,659,542	$ 9,363,182
Pigs, ingots, bars, plates and old copper	31,966,223	35,791,011
All other manufactured	47,339	52,526
Total	$39,673,104	$45,206,719

EXPORTS.

Ore, matte and regulus	$ 1,095,296	$ 3,123,865
Pigs, ingots, bars, plates and old	98,705,308	108,875,117
All other manufactured	5,107,802	5,083,802
Total	$104,908,406	$117,082,784

The Telephone and the Mails.

The New York *Telegram Review* well says:

Even if the sixty odd thousand postoffices in the United States should be closed Sundays there are seventy odd thousand places where Bell telephone service is rendered twenty-four hours every day in the year.

Large Hydroelectric Project in Norway.

The newspapers of Christiana, Norway, state that application has been made for a concession to dam up and harness the Aura and Lilledalen Basins to the east of Molde, in the Romsdalen district. The plans include a dam 130 feet high to keep back the waters of Aurojœn Lake and the transmission of the water thence to Sundalen either by a tunnel, affording some 197,200 horsepower, or by the old bed of the Aura, providing by various combinations about 250,000 horsepower. The estimated cost is at least $10,185,000, and if the plans are realized this will be one of the largest hydroelectric power stations in the world.

Chicago Electric Club Inaugurates Fall Meetings.

The first of the regular weekly meetings of the Electric Club of Chicago since the vacation period was held on September 19 in the West Room of the Hotel Sherman. A large attendance was on hand and many expressions of approval at the new quarters and service were heard.

William E. Mason, former United States Senator, was the speaker and he delivered a very interesting address on the subject of "Good Citizenship."

Niagara River Boulevard to be Electrically Lighted.

The 21-mile boulevard being constructed by the Niagara Falls Park Commission along the Canadian side of the Niagara River from Victoria Park at Niagara Falls to the ruins of old Fort Erie on the shore of Lake Erie will be lighted throughout its length by electric lamps placed at 100-foot intervals. It is said that this will be one of the finest driveways in the world.

Municipal Plant Refuses to Light Adjoining Town.

Through lack of authority to contract for so long a period with the municipal plant of Peabody, Mass., for street lighting, the town of Lynnfield is without lighting. The Peabody managers demand a five-year contract, but the Selectmen of Lynnfield are authorized to contract for lighting only to April 1, 1913.

Electric incandescent lamps of British make were sold to other countries during the first six months of this year to the number of 1,681,699, against 1,488,605 in the first half of 1911, and 1,277,669, in the first six months of 1910.

Two Electric Plants for Little Rock, Ark.

Another step has been taken in the project for providing a competitive electric lighting system in Little Rock, Ark. The first step was the granting last spring by the city council of a franchise to the Arkansas Cold Storage Company of a thirty-year franchise for a light plant. The Merchants' Lighting Company has just been incorporated with a capital stock of $400,000 common stock and $100,000 preferred, of which $25,000 has been subscribed.

The latter company is organized for the purpose of "building or leasing, operating and maintaining electric plants for furnishing power, light, heat or for any other purposes for which electrical current may be used, and for developing water powers and transmitting electrical current from water-power stations to Little Rock or other cities in the state of Arkansas, and furnishing light, heat and power and electrical energy to municipalities and all other consumers in such cities.

The Electrical Resistance of Special Steels.

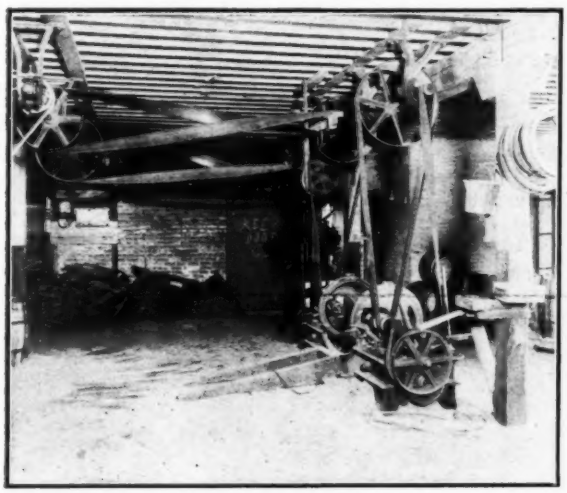
Octave Boudouard, in the *Comptes Rendus*, gives in tabular form the influence of different percentages of carbon on the electrical conductivity of nickel, manganese, chromium, and tungsten-steels of varying composition. In carbon-steels the resistance increases with the carbon content; in nickel-steels the resistance increases with the carbon content; ond with a constant percentage of carbon a rise in the percentage of nickel increases the resistance considerably up to a nickel content of 30 to 35 per cent, which corresponds with a compound $Ni\ Fe_2$. In manganese-steels the carbon content appears to have little influence on the resistance, the maximum being when 12 to 13 per cent of manganese is present.

Chromium-steels, whether they contain much or little carbon, show remarkable irregularities, the resistance rising and falling periodically as the chromium content increases. Tungsten-steels show an increase up to a certain concentration, then a minimum, followed by a further increase, irregularities which are not notably affected by the thermal treatment the metal has received. Benedicks's formula for the conductivities of steel, expressing the conductivity as a linear function of the sum of the concentrations of the different elements present, expressed in terms of their carbon equivalents, is found to hold good for the special steels studied.

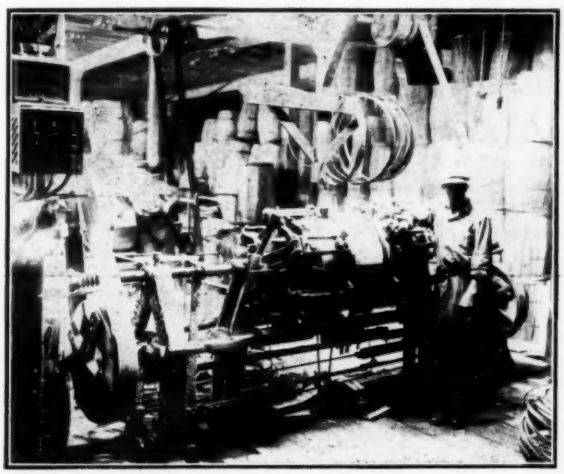
Electricity in Cooper Shops.

This article discusses operating conditions in typical cooper shops, pointing out the field for improvement as regards the motor equipment. Reasons are given for the installation of individual motors. Complete tabulated data are given concerning several plants.

An inspection of numerous cooper shops throughout the country seems to indicate that considerable opportunity is offered the central-station company for the sale of energy in this industry. In the average plant barrel staves are purchased and therefore the only woodworking machines required are for trimming the stock to the required size. Crozer machines for cutting ridges in the ends of the assembled staves, for the barrel heads, are the only other machines which produce wood waste. The amount of wood refuse is therefore not great, usually about sufficient to supply the necessary steam used. While the conditions outlined apply to the average plant, a few large shops manufacture their own barrel staves from the rough lumber, necessitating the use of considerable woodworking machinery. Conditions in these plants, however, do not differ from other woodworking establishments which, as has been pointed out in previous articles, can in most instances profitably purchase power from a central station. All phases of operation in woodworking plants have been treated in previous issues. The following discussion will therefore only deal with the manufacture of barrels and kegs in plants where staves are purchased.



Motor-Driven Crozer.



Motor-Driven Hooping Machine.

Conditions in this industry can best be pointed out by a description of a typical installation. The Daniel Burkhartsmeier Cooperage Company's plant, located in Chicago, does a general cooperage business, manufacturing both slack and oil barrels. Under present conditions the average weekly output is from 350 to 500 barrels but improvements in shipping facilities, now under way, will increase this production considerably. The capacity of the plant is in the neighborhood of 1,000 barrels per week, exclusive of the business in second-hand barrels which varies from week to week. All staves used in this plant are purchased, and need only to be cut to the desired size before assembling. For trimming staves a set of double jonters, manufactured by the J. S. Oran Company, are used in this plant. Under ordinary conditions of operation a 7.5-horsepower motor is sufficient to run ths machine but in the Burkhartsmeier plant a 10-horsepower machine running at 1,150 revolutions per minute is used. This motor, which is of the squirrel-cage induction type, is first belted to a 10-foot shaft, supported by three hangers, and the jointer driven from this shaft.

After the staves are cut to the proper size they are assembled in what is known as a barrel raiser. These machines by means of a looped cable draw in the staves so that hoops can be placed on the barrels. In the slack-barrel department of the cooperage under question, the barrel raiser, manufactured by the E. & B. Holmes Machinery Company is driven from a line shaft, as shown in one of the accompanying illustrations. The motor driving this shaft is a 10-horsepower squirrel-cage induction machine, running at 1,150 revolutions per minute. A tressing machine, a No. 97½ hoop stapler, a crozer and a re-hooping machine, all of E. & B. Holmes manufacture, all are driven from this same motor. The barrel after leaving the raiser is held in shape by the hoops which are placed on it by hand. The function of the tressing machine is to mechanically press the hoops on the barrel, in their permanent location. The crozer is a machine which cuts ridges in the ends of the assembled staves to receive the barrel head. Barrels are placed in this machine after leaving the tressing machine and when this operation is completed are ready for the heading up machine.

The machines previously referred to are all located on the third floor of the building. On the second floor, one 10-horsepower, 1,150-revolutions-per-minute squirrel-cage induction motor is belted to a 16-foot four-hanger line shaft driving a windlass, one tressing machine, one crozer and one bung-boring machine. On this floor are also located a heading-up machine, driven directly by a 5-horsepower squirrel-cage induction motor running at 1,750 revolutions per minute; a barrel turning lathe and hooping machine both driven by a 5-horsepower 1,750-revolutions-per-minute motor; and a punch press, hoop expander, riveting machine, and chain conveyor, all connected to a 10-foot three-hanger line shaft driven by a 5-horsepower squirrel-cage motor running at a speed of 1,150 revolutions per minute. The punch press

and hoop expander are of the William Glader Company's manufacture and the riveter an E. & B. Holmes machine. The chain conveyor is about 30 feet high and is inclined at an angle of 60 degrees. It is used principally for raising staves from the stave-receiving department, on the first floor, to the desired departments.

In the second-hand barrel department, located on the ground floor, a 5-horsepower squirrel-cage induction motor running at 1,150 revolutions per minute drives a washing machine which scours both inside and outside of the barrels. A hooping machine and bung-boring machine driven by a 5-horsepower motor are also located in this department.

In the Burkhartsmeier plant all refuse is burned to generate the steam necessary for the oil-barrel machines. During the summer months all waste in excess of that needed for this purpose is stored for winter use, so that a comparatively small amount of coal is purchased during the heating months. This arrangement has effected a substantial saving and reduced the operating costs in this plan to a minimum.

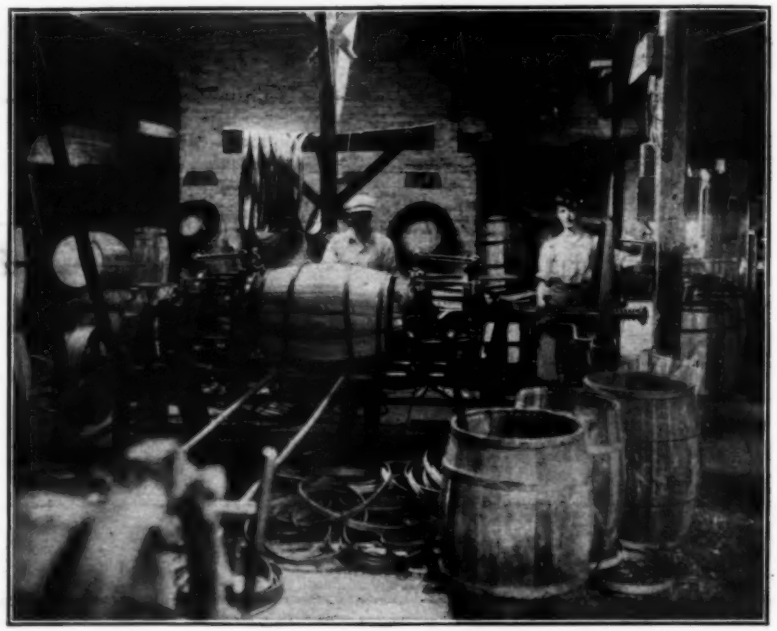
A cooper shop, located in the East devoted to the manufacture of white-oak whisky barrels exclusively, is another installation that, being typical, gives an indication of conditions in the average plant. This establishment, with the equipment at present installed has a monthly capacity of 4,500 barrels and an average monthly output of 3,500 barrels. To handle this production nine men are employed, working nine hours per day.

Machine.	Horsepower Required.
Adjacent equalizer	3
Stave dresser or bucker	5
Single jointer	3
Double independent jointer	7.5
Heading jointer and doweling mch.	3
Hoop flaring machine	3
Bung boring machine	1
Bung boring and bush driver	2
Stave planer	5
Large hooping machine	5
Crushing machine	5
Barrel planer	2
Stave bending	1
Dryer	20

Two squirrel-cage induction motors having a total capacity of 45 horsepower are installed, the maximum demand being about 35 horsepower. The larger motor in this plant is a 40-horsepower squirrel-cage induction machine, running at 850 revolutions per minute. It is connected to a 50-foot line shaft, supported by five hangers, and drives one trussing machine, one single-end barrel windlass, one barrel lathe, one thin hoop driver, one double riveting machine, all of H. N. Strait manufacture, and one hoop-flaring machine, one 54-inch double-wheel stave jointer, one bung-boring machine, one 30-inch grindstone and one double-end chamfering machine.

The smaller motor is a 5-horsepower squirrel-cage induction machine, running at 1,700 revolutions per minute, and is belted direct to an A. M. Benson Company barrel-size stave-bucking machine.

The kilowatt-hour consumption of this installation for a period of 12 months is as follows: August, 939; September, 1,072; October, 1,856; November, 2,596; December, 1,102; January, 3,102; February, 3,248; March, 2,598; April, 3,078; May, 2,742; June, 1,598; and July, 1,176. The total electric energy consumption per barrel manufactured is approximately 0.57 kilowatt-hours.



Barrel Tressing Machine for Pressing on Steel Hoops.

From the foregoing descriptions of the equipment in typical plants some idea can be obtained of the power requirements of the various machines used in the industry. Additional information is given in the accompanying table.

Motor-Driven Barrel Raiser for Assembling Staves.

While the two plants previously referred to employ group drive, individ-

(Continued on page 587.)

Cooper Shops—Data Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Cooper shop, name withheld. Combination drive. Running hours per week, 60.

Total connected horsepower, 47. Number of motors, 9. Average kilowatt-hours per month, 2,687.

Kilowatt-hour consumption for 10 months: November, 1,550; December, 2,020; January, 2,850; February, 2,920; March, 2,760; April, 2,720; May, 2,630; June, 2,870; July, 3,030; August, 3,520.

Load-factor, 10.4 per cent; operating-time load-factor, 21.5 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts:

No.	Horse-power.	Speed R. P. M.	Application.
1	3	1,700	Belted direct to a 16-inch swing cut-off saw.
1	7.5	1,700	Belted to a 5-foot shaft driving an Atlas self-feed glue jointer, 6,100 revolutions per minute.
1	15	1,700	Belted to a Borg & Beck Company self-feed stave machine, staves are 16 inches by 2⅜ inches by ⅞ inch.
1	7.5	1,120	Belted to a 50-foot shaft (six hangers) driving one J. S. Oram barrel-hooping machine; one lathe used for sandpapering tubs; one hoop bender, roll 8 inches by 12 inches; one hoop flaring machine; one hoop punch and riveter; and one 36-inch by 45-inch grindstone.
1	3	1,120	Belted to an Egan 36-inch by 0.25-inch band saw.
1	3	1,700	Belted to an 8-inch friction-feed cut-off saw.
1	5	1,120	Belted to a two-hanger shaft driving a heading cutter.
1	1	1,700	Belted to a two-hanger shaft driving a barrel conveyor.
1	2	1,700	Belted to the arbor of a 14-inch cup saw.

Barrel works, manufacturing barrels for cement and plaster, principally. Group drive. Running hours per week, 60.

Total connected horsepower, 30. One squirrel-cage induction motor is installed. Average kilowatt-hours per month, 1,254.

Kilowatt-hour consumption for 8 months: January, 800; February, 790; March, 1,420; April, 1,630; May, 1,390; June, 1,310; July, 1,270; August, 1,420.

Load-factor, 9 per cent; operating-time load-factor, 16 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	30	850	Belted to a 20-foot shaft (four hangers) driving one Sturtevant No. 5 blower, 1,000 revolutions per minute; one E. & B. Holmes barrel tresser driven by two belts, used for pressing steel hoops on barrels; one Holmes barrel raiser for drawing in ends of staves so that steel hoops can be loosely placed on barrels; one Holmes No. 33½ crozer used for cutting ridges in end of assembled staves to receive barrel head; one Ideal hooping-off and heading-up machine; one Buffalo No. 2 blower, attached to above machine; one Holmes punch press for riveting steel hoops, flywheel 46 inches diameter; one William Gladner hoop expander, 72 expansions per minute; and one 12-inch by 30-inch belt conveyor inclined at 30 degrees.

Cooper shop making white-oak whisky barrels. The plant has a monthly capacity of 4,500 barrels and an average monthly output of 3,500 barrels. Fifteen men are employed working nine hours per day

Total connected horsepower, 45. Total number of motors installed, 2. Average kilowatt-hours per month, 2,092.

Kilowatt-hour consumption for 12 months: August, 939; September, 1,072; October, 1,856; November, 2,596; December, 1,102; January, 3,102; February, 3,248; March, 2,598; April, 3,078; May, 2,742; June, 1,598; July, 1,176.

Load-factor, 8.6 per cent; operating-time load factor, 17.8 per cent.

Measured maximum demand, 35 horsepower.

The total electrical energy consumption per barrel manufactured is 0.57 kilowatt-hour.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	850	Belt-connected to a 50-foot, five-hanger line shaft which drives one trussing machine, one single-end barrel windlass, one barrel lathe, one thin hoop driver, one double riveting machine (all five preceding machines of H. N. Strait Manufacturing Company), one hoop flaring machine, one 54-inch double-wheel stave jointer, one bung-boring machine, one 30-inch grindstone, and one double-end champhering off machine.
1	5	1,700	Belt connected to an A. M. Benson Company barrel-size stave bucking machine.

Cooper Shops—Data Sheet No. 2.

Daniel Burkhartsmeier Cooperage Company, Chicago, Ill. This plant makes all kinds of slack and oil barrels, having an average output of 500 barrels per week. A second-hand department is also maintained. The running hours per week varies.

Total connected horsepower, 55. Total number of motors installed, 8. Average kilowatt-hours per month, 2,459.

Kilowatt-hour Consumption for 12 Months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
September	2,205	January	3,337	May	1,434
October	1,886	February	3,367	June	1,893
November	2,305	March	3,549	July	1,341
December	3,604	April	2,946	August	1,640

Load-factor, 8.1 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed in this plant, with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type:

No.	Horse-power.	Speed R. P. M.	Application.
1	10	1,150	Belted to a line shaft driving one barrel raising machine; one tressing machine; one E. & B. Holmes Machinery Company, No. 97½ hoop stapler; one E. & B. Holmes Machinery Company crozer for grooving ends of barrel staves; and one hooping machine.
1	10	1,150	Belted to a 16-foot line shaft (four hangers) driving one windlass; one tressing machine; one crozer; and one bung boring machine.
1	10	1,150	Belted to a 10-foot three-hanger shaft driving one set of J. S. Oram jointers.
1	5	1,750	Belted to line shaft driving one turning lathe; and one hooping machine.
1	5	1,750	Belted direct to one heading-up machine.
1	5	1,150	Belted to a 10-foot line shaft (three hangers) driving one William Glader Company punch, for punching rivet holes in metal hoops; one William Glader Company hoop expander; one E. & B. Homes Machinery Company riveter and one 30-foot chain conveyor raising staves from first to second floors, incline 60 degrees.
1	5	1,150	Belted direct to one barrel washing machine.
1	5	1,150	Belted to a line shaft driving one Holmes hooping machine, and one bung boring machine.

Energy is supplied by the Commonwealth Edison Company.

Cooper shop devoted to the manufacture of tubs for washing machines. Group drive. Running hours per week, 54.

Total connected horsepower, 36. Total number of motors installed, 6. Average kilowatt-hours per month, 1,201. Average kilowatt-hours per month per connected horsepower, 33.4.

Kilowatt-hour consumption for 9 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
April	900	July	1150	October	1026
May	1200	August	1229	November	1920
June	806	September	1026	December	1500

Load-factor, 6.1 per cent; operating-time load-factor, 19.7 per cent.

MOTOR INSTALLATION.

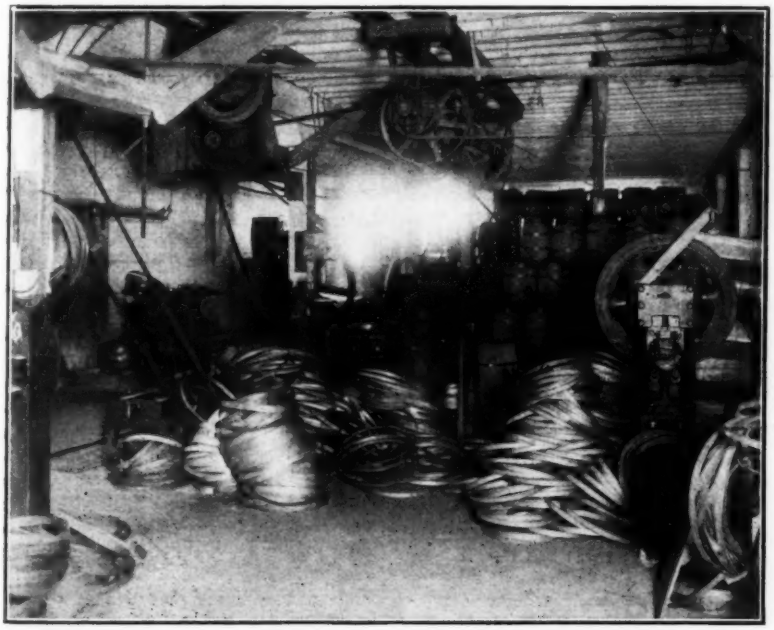
The following is a list of the motors installed in this plant with their respective drives. The supply source is two-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	15	1,800	Belted to a line shaft driving one Universal stage machine, capacity 1,000 per hour; one equalizing machine, capacity 1,000 per hour; and one Hoosier rip saw.
1	5	1,800	Belted to a line shaft driving one heading machine; and one spindle shaper.
1	5	1,800	Belted to a line shaft driving: One 24-inch planer. One 14-inch swing cross saw.
1	5	1,150	Belted to a line shaft driving: One automatic screw driver. One variety saw. One 12-inch jointer. One 32-inch band saw.
1	3	1,800	Belted to a line shaft driving: One hoop driver. One tub sander. One drum and disk sander.
1	3	1,800	Belted to a line shaft driving: One E. & B. Holmes hooping machine. One E. & B. Holmes bung-boring machine.

ual drive throughout is preferable and practically all modern installations are being so equipped. One of the most

Heading-up Machine in Burkhartsmeier Cooperage.

important advantages of individual motor drive in a cooper shop is the saving in floor and overhead space due to the elimination of belts and



Motor Driving Punch Press, Riveting Machine and Hoop Expander.

shafting. It has been proven in several plants that this item is alone of sufficient importance to justify the increased investment necessary. Also in a cooperage very few machines are in actual service more than half of the time, and with individual drive, the cessation of all energy losses chargeable to each machine, except while it is in productive operation, constitutes a very large saving in power. Other advantages of individual drive such as greatly increased production, better lighting and ventilation, absence of breakdown troubles, reduced fire risk, etc., are worthy of serious consideration when an installation is contemplated. The reduction of fire risk is particularly important in cooper shops as sawdust and frequently explosive paints and oils are present. If power is obtained from an adjacent steam plant the fire risk is great and insurance rates correspondingly high. Mechanical drive necessitates either the dangerous proximity of the boiler room or heavy losses in long steam mains or belt transmission. When central-station power is used all danger from adjoining power plant is removed; in any case electric drive does away with the inflammable dust inevitably carried into the engine room by the large belt. The elimination of heavy line shafts also greatly reduces the danger of fire from overheated journal boxes and also from spontaneous combustion.

Of course the relative values of group and individual drive must be determined in every instance by a careful analysis of the requirements of the installation. It is the consensus of competent opinion, however, that in a large majority of cases the highest efficiency, both for the machinery to be driven and for the electrical equipment, can best be obtained by the application of a separate motor to each unit. There are other conditions that have an important bearing on the selection of drive for cooper shops that should be given due consideration. In modern establishments, high productive capacity will hinge largely upon the convenience and rapidity with which work may be handled. Therefore costly equipment may fail to realize possibilities unless the machines be installed with entire independence of the usual fixed line shaft conditions. In shops where productive machines are widely separated, one from another, or where occasional machines must be reached by long lines of shafting, individual drive is vastly more economical and generally preferable.

In connection with the use of central-station service it is well known that the possibility of a complete shut-down in a central station is remote as there is always a spare unit ready to be placed in service in case of accident. The large number and greater skill of the operating force secures the maximum speed in the repair of damaged parts. On the other hand, a shut-down in an isolated plant is liable to be prolonged by inferior facilities available to the operators, their own small number and lesser ability to cope with emergencies. Shut-downs are expensive for even though a part of the payroll may stop with the machinery, as when the men are on piece work, still the production has been curtailed by an amount proportional to the duration of the shut-down. The investment charges go on whether the machines are running or not; every delay represents lost production which

permits the unfilled orders to accumulate.

As to the selection of motors for drive in cooper shops, no especial difficulty is encountered. Direct or alternating-current motors may be used but the latter are preferable owing to the absence of sparking troubles.

If only direct-current supply is available, motors should be compound wound or of the interpole variety when applied to woodworking machines. Motors of this type are necessary since it is absolutely necessary that they be capable of resisting the excessive peaks which are apt to occur. Motors when exposed to the refuse and sawdust should be inclosed. Shunt-wound motors meet all the requirements of cooperage machines, proper.

Where alternating-current supply is available, the polyphase induction motor with high-resistance squirrel-cage rotor should be specified, as the high-resistance rotor permits quick and frequent acceleration and provides the starting torque necessary.

Commercial Practice
Management, Rates, New Business

DOLLARS AND FACTORS.[1]

By C. J. Russell.

The present paper will deal in a very elementary way with the relations between dollars and those factors affecting the economic results of their utilization with special reference to public utilities.

When we desire to obtain an idea of the progress or present status of an industry or of a commercial undertaking we naturally seek statistics showing:

First. Dollars invested, assets, capital consisting of dollars or their equivalent.

Second. Dollars of annual income, gross earnings or production in goods.

Third. Dollars of annual expenditure, operating and maintenance expenses, purchase of materials and replacement of capital destroyed.

Fourth. Dollars of gain or loss, representing the net results of a year's operation.

Taking a case typical of our manufacturing industries as shown in the census reports recently issued for the year 1909, we find:

(1) Capital, $100,000; (2) gross earnings, $112,000; (3) expenses, $100,134; (4) apparent net gain, $11,866.

Taking the figures of an electric utility for the same year we find: (1) Capital, $477,422; (2) gross earnings, $71,566; (3) expenses, $46,144; (4) apparent net gain, $25,422.

The figures of a retail cash grocery business for the same period were: (1) Capital, $8,000; (2) gross earnings, $71,000; (3) expenses, $66,000; (4) apparent net gain, $5,000.

These statistics give us a fair idea of the relative financial importance or rank of the three commercial undertakings. It is the relation of the figures to each other, however, that principally impresses us and is of prime importance. It will be noted that for each dollar of capital, the gross earnings of the manufacturing business have been $1.12, of the electric utility not quite 15 cents, and of the retail grocery, $8.875. In other words, the capital of the first has been "turned over" one and one-eighth times in a year, the capital of the electric utility at the rate of once in practically seven years, while that of the grocery business has been turned over almost nine times within the year. An examination of the business of the grocery store will show that only a small amount of the total capital exists as fixed investment, the transactions consisting largely of the circulation of capital through the purchase and rapid sale of household commodities. In the manufacturing business we find a larger proportion of fixed to circulating capital but even here the purchase of materials and labor may call for five-sixths of the total expenditures. In the electric utility we find that the ratio of fixed to circulating capital is very high, the figures themselves furnishing a rough indication of this fact.

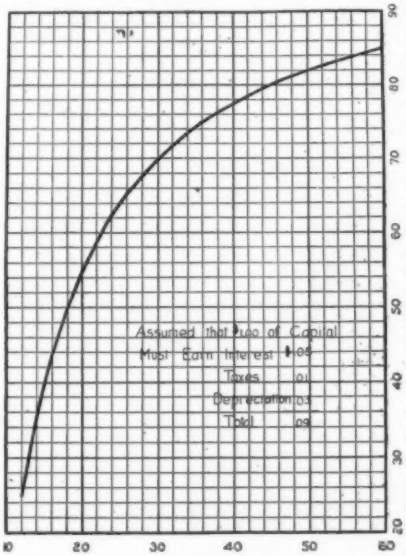


Fig. 1.—Highest Percentage of Gross Earnings that May be Used for Expenses at Different Ratios of Gross Earnings to Capital.

It will be noticed that the total expenses of the manufacturing business have been 89 per cent of the gross earnings, while in the electric utility they have absorbed 64 per cent of the gross earnings and in the retail grocery they have been 93 per cent of the total income. In order to fix in our minds the importance of the relation of these figures to each other let us assume that a moderate amount of additional gross earnings could be obtained without increased capital and that the ratio of expenses to earnings would remain the same. If a dollar of income were added to the manufacturing business the expense would increase 89 cents and the net returns increase 11 cents. If a dollar of new business were added to the electric utility the expenses would increase 64 cents and the net returns 36 cents. In the grocery business a dollar of increased gross earnings would cost nearly 93 cents in expense and the net returns would show a gain of a little over seven cents.

These figures give us a rough idea of what additional business means and of its special importance and value to the electric utility. They do not, however, do full justice to the value of additional gross earnings in that undertaking, for the reason that the ratio of expense in such additional business will not remain the same. As has been stated before the ratio of fixed to circulating capital is very high in the utility under consideration. Fixed investment leads to fixed charges per se but the very nature of all forms of public utilities creates a high ratio of fixed expenses sometimes called "Standby or Readiness-to-Serve" charges as compared with those expenses which vary with the actual production or output. For this reason a very large percentage of additional gross earnings will be found in the apparent net gains and

1 From a paper presented before the recent convention of the Pennsylvania Electric Association.

a very large percentage of the dollars deducted from income through lost business will substract themselves from the net gains.

We may therefore see from a consideration of these figures that the relation of gross earnings to capital and the relation of expenses to gross earnings are important factors in fixing the value of a given undertaking from the investor's standpoint. The accompanying curve, Fig. 1, shows in graphic form the exact meaning of these relations.

The diagram is based upon the assumption that 5 per cent interest must be paid upon the capital invested, that annual taxes to one per cent of the same amount must be paid and that 3 per cent must be set aside annually for replacement of capital destroyed through depreciation, obsolescence, etc. It is obvious that the percentages mentioned may be changed and that they are merely used to illustrate a principle. The diagram shows that when the annual gross earnings upon $1 of capital are 12 cents, the operating expenses must be kept with 25 per cent of the gross earnings or the payments mentioned cannot be made. When the gross earnings are 20 cents for each dollar of capital the operating expenses may reach 55 per cent of the gross earnings and the payments specified may be made. If the gross earnings equal 36 cents for each dollar of capital the expense may be 75 per cent of the earnings, and so on.

A careful examination of this diagram will show that these relations furnish a true index to the present value of any business as an investment. They are particularly valuable in considering the figures of a public utility because the ratio of gross earnings to capital in such undertakings will ordinarily be found between 10 and 35 per cent.

It is also apparent from this diagram that an important factor in the value of an investment may be found in the new business that can be obtained without a proportional increase of capital. It may be of interest, without going into all the points bearing upon this factor in a public utility, such as size and character of population and territory, general business stability and conditions, present sales per capita, etc., to examine with the aid of another diagram the meaning of additional business to net returns when capital need not be increased.

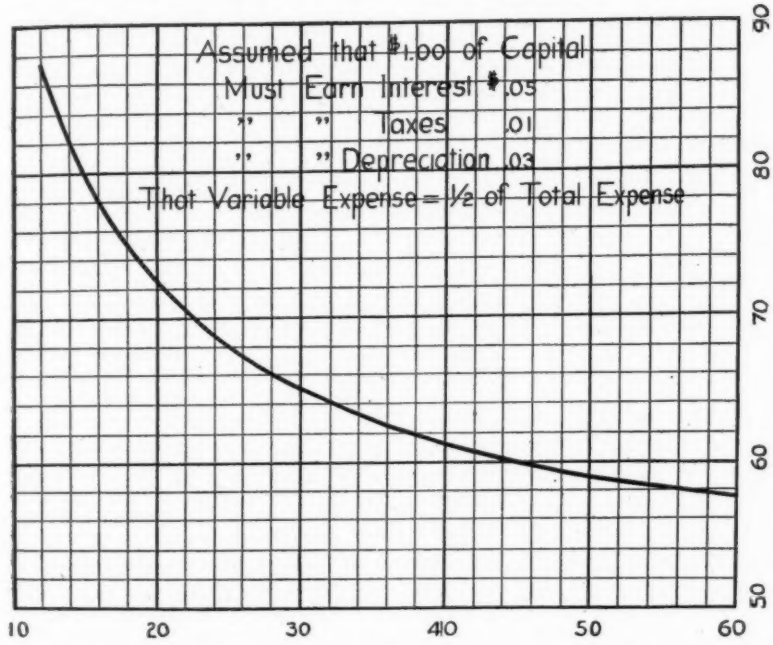


Fig. 2.—Vertical Lines Represent Cents of Gross Earnings per Dollar of Capital. Horizontal Lines Represent Cents Applicable to Net Gains Out of Each Dollar to Additional Gross Earnings.

The basis of Fig. 2 is the same as of the preceding diagram, namely: That 5 per cent interest, one per cent taxes and 3 per cent capital replacement must be provided for annually. It is further assumed that one-half of the total expense is fixed and one-half variable. The curve shows the percentage of each dollar of additional gross earnings that will appear as apparent net gain at the different ratios of gross earnings to capital under the conditions assumed. When each dollar of capital is bringing in 12 cents in gross returns (from which amount 5 per cent interest, one per cent taxes and 3 per cent capital replacement are paid), a dollar of new business or additional gross earnings turns 87.5 cents over to net gain. When each dollar of capital is bringing in 20 cents gross per year, a dollar of additional earnings will add 72.5 cents to net gains.

This curve illustrates fully the desirability of increasing gross earnings when the ratio of the same to capital is from 12 to 60 per cent. We can readily see that considerable expense for soliciting, advertising, etc., will be justified by the results of such additional revenue.

Increasing Productive Capacity Per Dollar of Capital.

The improvement of the ratio of revenue to capital is one of the most important matters with which we deal. Dollars of capital represent principally, in our case, productive and distributing facilities. Dollars of revenue come from sales of the commodity we produce and distribute. A dollar of capital represents a certain unit amount of generating and distributing capacity. A dollar of revenue represents a certain number of kilowatt-hours sold. If a dollar of capital represents a capacity of two watts placed at the disposal of a customer at the price of ten cents per kilowatt-hour, a ratio of 12 per cent means that we have received payment for the use of that capacity 600 hours in the year. It is obvious that an improvement in the relation of gross earnings to capital may be made by lowering the amount of capital, increasing the dollars of gross earnings or through a combination of both methods. The first method results in a larger capacity per dollar of capital and is being exemplified all over this country today in the consolidation of supply to communities formerly served by several companies and in the concentration of productive facilities in large generating stations and of distributing facilities in great net-works covering many square miles of area. Recognition of the principle involved is back of the present feeling against duplication of investment for the performance of a given service and against the waste of capital brought about by competition where one commercial undertaking can supply the necessary facilities and service. The consolidation of manufacturing plants, the combination of competing companies, the very centralization of population all proceed from this economic cause. Its importance has been set forth in many decisions of Public Service Commissions dealing directly with questions of the public utilities.

It may be said, in fact, that the very existence of a public utility is due to the basic principle here involved. Any person can, by the use of enough capital, have his own gas or electric plant, his own water supply, his own sanitation plant or provide his own transportation. The waste of capital through such investments at a high rate of unit cost on account of the small sized plants, would be tremendous, for the amount of capital tied up in fixed investments would be enormously in excess of that used for the common supply of such utilities.

This is the fundamental principle leading to the existing contracts between electric railways and central stations and

between large power users and electric power companies. A dollar of capital buys a larger unit of generating capacity in the central station, has a higher productive value in the railway or factory, and the relation of gross earnings to dollars invested is consequently increased in both.

The rapid development of our own business has resulted in improvement in this relation. We all know that we can add to our plants at a less cost per kilowatt of capacity than our present average figure for existing plant. Such additions will consequently decrease the average cost per unit of earning capacity and thus increase the ratio of gross earnings to dollars of capital if the new business obtained brings in the same average revenue or more for each dollar invested.

It is hoped that these statements may convey some idea of the importance of increasing the productive capacity represented by a dollar in our public utilities, for this point is fundamental, vital and economic.

Increasing Gross Earnings.

The importance of increasing gross earnings has already been touched upon. It has been shown that the utilization of existing capital to bring in additional dollars of earnings is of supreme importance. In fact the improvement of the utilization of capital is one of the most serious questions before the business men of the present time. The load-factor of a dollar—the ratio of its actual to its maximum productive earnings—is the question we must continually keep before us.

The figures of public utilities show that the ratio of earnings to capital is low in all of them and we know this is due in a great measure to factors over which they have no control. The ratio represents the actual utilization by the public of the resources placed at their service and corresponds to the average demand of those served for the form of service supplied.

Load-Factor.

In all utilities the question of maximum capacity required in the business is of first consideration, as this must evidently be at least equal to the maximum simultaneous demand for service. This demand, present and estimated, fixes the amount of capacity to be provided and consequently the amount of capital to be invested. In the case of companies selling electric current the ratio of the utilization of this capacity is called load-factor and is expressed as a percentage of the maximum possible utilization.

The average load-factor of central stations in this country is said to be from 20 to 25 per cent, based upon the maximum simultaneous demand. Figures of the average degree of utilization of their plant capacity are not available, but it is safe to assume that the percentage is much lower than that based on demand. From data collected in this and other countries it is doubtful if the average figure would be higher than 15 per cent.

We all recognize the importance of load-factor and are familiar with the conditions that cause such a low percentage of utilization on the part of the public we serve. The National Electric Light Association has carried on for some years highly important research work upon the subject and the data obtained have been classified and put in the hands of its members. As a consequence of this we know that load-factors may be anticipated in the various classes of business available in our respective territories.

If we undertake to analyze the data obtainable from the experience of others and from our own past and present figures, we must all admit that the question of improving our load-factor is not an easy one to solve. It will take an enormous proportion of long-hour business to increase the load-factor from 20 to 40 per cent, as can readily be seen by a few figures. In fact, we must double our existing load and the business gained must have a load-factor of 60 per cent in order to accomplish such a result. The possibility of securing an amount of business equal to that we now have and which will use the maximum demand over 14 hours a day is remote in most cases.

Considering the subject of increasing load-factor from an elementary point of view, we shall find that it must proceed from stimulating the average demand of present consumers without increasing their maximum demand during peak periods, or from getting new customers whose needs for current will not coincide with the demands of the consumers now supplied.

One of the most important methods of stimulating the demand of existing customers is by calling to their attention every form of current-consuming devices and the introduction of such appliances should be pushed in every possible manner. The sale of heating, ventilating and small-motor appliances to our present customers is a matter of importance secondary only to the obtaining of new business. In fact, the sale of such an appliance as an electric iron is as important under ordinary circumstances as the signing up of additional business of half its capacity. Some of these devices use only a small amount of current, but we have already seen the effect of every additional dollar gained in gross earnings from existing investment.

Diversity-Factor.

The second method of increasing load-factor conforms to ordinary business practice in other commercial undertakings.

Restricted-hour business offers the most obvious method of accomplishing the result. In practice, however, restrictions as to hours of service are undesirable and must be compensated for by a liberal reduction in rates. If business of such character is taken on in large amounts it is possible that the maximum demand might be shifted over and occur within the time when such business is permitted to take current. In fact, the author has data of several cases where this has actually occurred, and in those cases the restricted-hour business is now undesirable and business of the regular kind of service requirements extremely desirable. For these reasons it would appear that in the average case a careful study of existing conditions and load-factors should be made and the efforts to improve load-factor governed by the results of this study.

The real aim is to improve the diversity-factor, which is the ratio between the sum of the maximum demands of our consumers and the actual maximum demand upon our generating station.

If a dollar of capital represents two watts of capacity at the premises of a consumer and we can sell this capacity to a cold-storage or ice plant from 1 to 5 a. m. and to a factory from 7 a. m. to 6 p. m., with the exception of the noon hour, and to a theater from 7:30 to 11 p. m., it will have been utilized seventeen and one-half hours per day. The diversity-factor in such an assumed case will be three, and this means, as compared to a unity diversity-factor, that the ratio of gross earnings to capital has been multiplied by three, as compared to the average earnings in the three classes of business. In other words, the results in earnings are the same with $1 of capital as for $3 of capital with the same average load-factor and simultaneous maximum demands.

A little reflection upon this subject will show that diversity-factor is of the greatest possible importance to the small company where units of generating and distributing capacity have a high cost. Reference has already been made to the importance of increasing the productive capacity representing a dollar of capital. The improvement of diversity-factor accomplishes this result by obtaining the same results with one watt of capacity that could be obtained by two or three times that amount if the maximum demands were simultaneous. In other words, a small station with a diversity-factor of three is on the level of a large station where the cost per kilowatt of capacity is one-half of that of the small station, but the diversity-factor is 1.5.

The obtaining of a diversity-factor of twice our present figure may not be practicable in most cases, but we must remember that an improvement of even 10 per cent will produce remarkable results and increase the load-factor of every dollar of our capital.

Diversity-factor results from the connection of any class of business to our system in which the maximum use occurs at any other time than the present maxi-

mum demand upon our generating station.

Diversity-factor also results from the connection of two or more installations in which current is used intermittently.

Summer business of all kinds, business conducted only by daylight and business conducted between 9 p. m. and dawn offer, along with business of an intermittent character, the most promising fields for the improvement of load-factor through increased diversity-factor.

Power-Factor.

In considering the question of increasing the ratio of gross earnings to capital we are confronted in alternating-current plants by the problem of power-factor. The effect of this factor, if below unity, is to decrease the productive value of a dollar invested in generating and distributing apparatus and facilities to its own figure. A power-factor of 75 makes the productive value of a dollar of such investment equal to that of 75 cents of investment with unity power-factor. The other effects of this facor are serious but will not be discussed at this time, as the above statement shows its result upon a dollar of investment, and this with a low ratio of gross earnings is a very serious matter.

The correction of low power-factors has been given a great deal of attention and many papers and articles have appeared upon the subject. It is obvious that spending money to make the dollar as productive as before—in other words, to raise the power-factor back toward unity—can never quite accomplish the result. For this reason it is important that this restrictive factor should be given due recognition and carefuly watched. It is insidious in its effects and preventive measures must be used in order to check its restrictions upon the earning power of our dollars. Every installation should be given careful consideration and due attention must be paid to the size and character of all kinds of inductive apparatus connected to our lines. Every installation connected which has a high power-factor improves and every one with a low power-factor detracts from the average results. For this reason the commercial forces must keep in close touch with the engineering departments in handling installations of inductive apparatus or appliances.

Ratio of Expenses to Gross Earnings.

The importance of the ratio of expenses to gross earnings, especially when the latter have a low ratio to dollars of investment, has already been shown. We also fully understand the necessity of keeping a close watch upon expenses of every description, for this is the period of scientific management and the ideal cost of production is continually being refined. The present paper will not, however, go into the various factors affecting our efficiencies of generation and distribution, for the reason that the subject is an old one, is receiving constant attention and is in good hands with our operating forces.

Leaving out of consideration the question of our operating and distribution efficiencies, there are just two methods of improving the ratio of expenses to gross earnings. One is to improve our load-factor, which means to improve the average rate at which current is made and distributed. The other is to generate current upon a large scale. Both these methods also accomplish the result of increasing the ratio of gross earnings to dollars of capital. A careful analysis of the expenses in cases where each method has been successful should be made by every person interested in the future of our business, for the results are full of interest and furnish food for thought. Figures from plants in this and other countries where a high load-factor in moderate sized station has been obtained seem to show that the decrease in cost per unit for operating and maintenance has not been as great as might be anticipated, but that the main reduction has occurred through the decrease in fixed charges per unit and that the real benefit in net results has been almost entirely due to the increased amount of gross earnings per dollar of capital.

Figures from some of the great generating stations of this and other countries show that generating costs have reached a remarkably low figure per unit kilowatt-hour and that the expense of distribution per kilowatt-hour now holds the attention of those who make a study of expense items. These great systems result, however, in a low average cost per unit of capacity; in other words, in a relatively large amount of productive capacity per dollar of capital invested. They also result in a high diversity-factor on account of the diversity of business supplied. Both of these points result in a high ratio of gross earnings to dollars invested.

Points of Commercial Importance.

While the present paper has been confined principally to the relations of dollars of capital, earnings and expense in our own industry, it is hoped that it will be understood that what has been said will apply to any form of business with equal force. Certain points in this connection are worthy of consideration, however, as they have an important bearing upon our negotiations for the supply of current as against isolated plants.

The first is, that no man or corporation can afford to invest a dollar of capital in an isolated plant if by investing it in productive business facilities he can materially increase his gross earnings. We all know from experience that the main point in all such cases is to prevent the original installation, for when the investment is once made the capital exists in the plant and must be made productive. When such is not the case, or the plant has reached a stage of obsolescence or inadequacy, the present paper may present some thoughts for a heart-to-heart talk with the investor. If his dollars can be invested so as to increase his gross earnings the curves shown in Figs. 1 and 2 represent what results can be accomplished by their use in such a manner instead of in a way which will only increase his ratio of expenses to gross earnings. With increased gross earnings per dollar of capital, dollars of expense become less and less a matter of urgent consideration and if such a prospective investor can be interested and made to accept the correct perspective our proposition should receive earnest consideration.

Another point is that any ordinary power user can, by increasing his dollars of gross earnings through the advantages offered by central-station service, readily obtain results that make his bill for electric current a matter worthy of little thought. Power represents in most manufactured products an extremely small proportion of the total expense. If through obtaining proper speeds and the increased speeds possible by the use of constant periodicity as small a gain in output as two per cent can be accomplished, the result in the added proportion of gross earnings to capital will make the power bill a negligible quantity. In one case known to the author of this paper an increase of 16 per cent of output has resulted from adopting central-station power, and the result in net gains to the manufacturer would have paid a power bill ten times the size of the one rendered. In another an increase of 6 per cent in output resulted. The saving in labor would have paid the bill for current, but as that labor could be made productive in other ways it was utilized, and in this case the net gains in one year increased slightly over 20 per cent.

An attempt has been made in this paper to show the importance of the relations existing between investment, revenue and expense and of those factors affecting them. The subject is one worthy of deep thought, study and discussion. The treatment of these subjects has been extremely elementary, but it is hoped that it has been presented in such a manner as to lead to further interest and an accumulation of data along the lines mentioned.

Motor Replaces Steam Equipment.

The Jefferson County Construction Company, a well known firm of Louisville paving contractors, has been equipped with electric power for the manufacture of asphalt. The peculiar advantages of a single unit of electric power in such instances have been well illustrated at this plant, for a single 45-horsepower motor now furnishes power economically for a series of manufacturing processes formerly supplied by a costly steam plant and a rather complicated transmission system.

Window Display of Boston Edison Company.

An artistic electrical display is just now attracting people to the Boylston Street window of the Boston Edison Building. The window has been draped with old gold velvet, centering attention upon a map representing the world. In the center of it is Boston. Here the scene has been mortised to give an extended view upon an enlarged reproduction of Bert Poole's panoramic "Twentieth Century Boston." The enlargement is 150 times larger than the original plate. This was 4 by 8 inches in size and the large picture is 48 by 100 inches.

The novelty of the exhibit lies in the treatment of the lighting effects that are secured by the use of a flashing device. Before the picture was framed a half dozen men mortised out with different sized punches the windows of the buildings shown in the view. This includes the wharf buildings along Atlantic Avenue, the office buildings in the center of the city, apartment buildings, State House and residences throughout other portions of the city and also the electric street lamps. More than 45,000 of these holes were punched in the picture.

Below the picture is reproduced, in colors, the Mechanics Building, and the outline and decorative lighting, which will be seen on the building during the forthcoming electric show.

The cycle of the lighting effects lasts for three minutes. First is the full illumination of the scene, representing daylight, followed by sunset, the development of moonlight effects with the flashing of the street lamps, the lights of the buildings down town, the lighting of the State House and the residence section. A particularly beautiful effect is secured along the Charles River reservation and out into the suburbs.

Electric Signs Becoming Popular in South America.

United States Consul F. W. Goding, of Montevideo, Uruguay, reports that for several years small electric street signs of American makes have been used in Uruguay, all of which gave only one reading. On January 20, 1912, the first large electric changing display sign was opened for service with a capacity for 40 advertsiements, each visible every seven minutes. It was manufactured in New Jersey at a cost, delivered in Montevideo, of $3,100, with a further cost of $3,000 for placing in position. The annual operating expenses will aggregate $7,000.

The sign is patronized by many of the leading local houses and newspapers and by a number from other countries. It is situated at the western side of the Plaza Independencia, through which pass thousands of people during the day and night, doubtless the best site in Montevideo. It is operated by Publicidad, a well-organized advertising concern there, which also places "ads" in the various newspapers, periodicals, street cars, and billboards through Uruguay, also supplying, free of cost, information relative to where advertising should be placed to produce the best results.

This sign is the property of a young Uruguayan, who spent two years in the United States making studies of the best American novelties to introduce into his native country. This venture has succeeded so well that he is now planning to erect similar signs, but of greater capacity, in other South American cities.

Electric Pumping for Oil Fields.

The use of electricity in the oil fields of California is proving to be a great economy. Pumping and drilling by electricity is very much cheaper than any other method. The San Joaquin Light & Power Company is doing a large business in this line. It is estimated that the average cost per day of pumping a well by steam is $9, while the average cost by electricity is $1.02. The majority of the wells pumped are about 1,500 feet deep, but some are 3,000 feet.

Co-operative Electrical Page in Chicago.

The "Peoples Electrical Page," which, from the electrical standpoint, has been very successful in Cleveland, Denver and several other cities has been permanently launched in Chicago under the supervision of the William D. McJunkin Advertising Agency. The Chicago *Tribune* for September 17 contained the page reproduced here.

Chicago's Co-Operative Electrical Page.

The page shown is truly a co-operative one and exemplifies the co-operation between manufacturers, jobbers, contractors and central stations which all branches of the electrical industry are trying to encourage. It is gratifying to those who have spent large sums of money and considerable time in this co-operative work to see the advertisements of the Chicago Electrical Contractors' Association, the Commonwealth Edison Company and the various representative Chicago supply houses all with the same message to the public—the wider use of electrical energy for light and power.

Electrical Construction

WIRING TO CEILING OUTLETS.

A Note on a Conduit Job.

When new buildings are being designed it frequently happens that there is difficulty in deciding upon the most desirable location for the outlets to be used in lighting certain portions of them. This is especially true as applying to ceiling outlets in office buildings. After a building of this sort has been practically finished it is necessary to arrange the offices to meet the needs of the respective tenants, as nearly as may be, and such arrangement is quite liable to call for revisions of the ceiling wiring and the addition of more or less numerous ceiling outlets. Several different types of construction have been employed in making the desired revisions. Sometimes rigid conduit is run from the nearest available junction box, on the ceiling, to another ceiling-outlet box installed just where the light or fixture is wanted, the ceiling being grooved to accommodate the pipe and the groove filled with plaster when the pipe is in place.

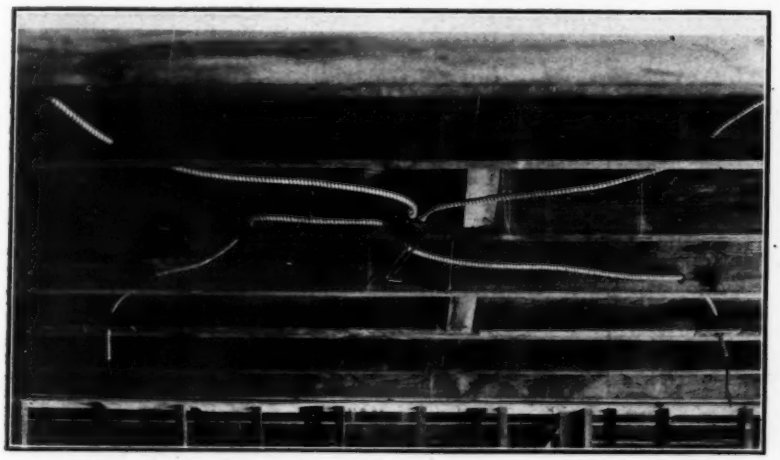


Fig. 1.—Junction Box and Extensions.

However, it is not intended here to discuss extensions of this sort. The aim of this note is to describe briefly the sort of construction adopted in the wiring of a large flat-building where it was decided to install ceiling outlets near the four corners of certain rooms, instead of having only one outlet in the ceiling of each one of them. The questions of the desirability of the kind of construction used and its relative merits compared with other ways of making extensions of the wiring in a building like this will not be gone into.

Fig. 2.—Another Similar Installation.

As the accompanying figures indicate, this was a conduit job, and the runs to ceiling outlets away from the centers of the room were made with metal-armored cable. The method of installing this cable is brought out rather well in Fig. 1. In a building of the type under consideration it is customary to lay a sub-floor directly on top of the joists, and to run the rigid conduits used for ceiling outlet and junction boxes over the surface of this, the floor proper being laid, on strips placed on the sub-floor, at some later stage in the erection of the house. The junction box shown in Fig. 1 is supported by the conduits on the sub-floor of the room above, the 2-by-4-inch timber to which such boxes are usually nailed being omitted. The steel-armored cables are brought out of the junction box, through knockout openings in the sides of it, by means of bushings of the type shown in Fig. 3. One end of this bushing is threaded, and the threads end at a shoulder, or sort of flange, beyond which the bushing is arranged to be clamped firmly around the metal armor and held there by means of a screw which tightens the clamp. The threaded end is pushed into the opening in the side of the box and the bushing secured in place by a locknut on the inner end of it. The cable, with the right length of wire projecting from it, is then pushed into place and clamped there.

Fig. 3.—Ceiling Plate and Cable Bushing.

The contractor who installed the work under consideration here explained that the local electrical inspection department objected to his running the armored cables along the surface of a sub-floor, as the rigid conduits were run, and that this was why he ran it in the manner shown in Figs. 1 and 2. He insisted also that the sort of work shown in Figs. 1 and 2 was more expensive than running extensions in rigid conduit, and that it was employed in the installation un-

der discussion only because it was best suited to the case in hand.

In this building what is known as a beam ceiling will be installed. The under side of the joists will be covered first with laths and plaster, in the ordinary way, and, then on the plaster painted wooden beams will be run to divide the ceiling up into artistic squares.

If fixtures are to be hung on the beam ceiling, the ends of the armored cables may be run vertically downward through holes in the beams to outlet plates of the type shown in Fig. 4. One of these plates can be nailed or screwed to the beam through holes provided for the purpose in such a position as to bring the cable through a knockout hole to one side of the center of the plate. Then a stud of the sort shown in Fig. 5 can be fastened in the center of the plate to hang the fixture from. The stud is held to the beam above by screws passing through holes around the center of the plate, and the fixture stem is attached to it with an insulating point or a "hickey."

In bringing the steel-armored cable through the ceiling-outlet plate, the bushing shown in Fig. 2 is used again, in a manner similar to that employed in running the cable into a junction box.

Fig. 4.—Fixture Stud.

When the fixture outlet is on the plaster of the ceiling, an outlet box like that shown in Fig. 6, or one deeper than this is employed, the box being nailed to the under side of a joist or other timber.

The junction box shown in Fig. 7 is on the ceiling of a room on the top floor. The conduit and gas pipe above the box are rather clearly shown.

Road Crossings with Overhead Wires.

It is pretty generally acknowledged that the wire-cradles which have been erected under high-pressure and extra high-pressure wires at road crossings are unsightly. But they are not only unsightly, they are also an expression of want of confidence in the construction which they are intended to guard; moreover, they themselves call for inspection and maintenance, they often give trouble, and they may even be a source of danger. This method of guarding was copied from Continental practice some ten years ago, when transmission of power by overhead wires began to develop in this country. Every engineer feels that cradles are clumsy, but nothing better appeared to be forthcoming for some time.

In the North-East coast district the so-called catenary suspension was adopted. A strong earthed cable of stranded steel wires carried the conductors, placed one below the other in a vertical plane. A lower earthed wire was sometimes added, making a sort of five-barred gate. The conductors were carried by insulators attached to vertical drop wires. The arrangement entailed increased height of poles and a considerable number of insulators.

A modification has now been made. Substantial rectangular frames with wooden crossbars and tubular uprights are carried on four span wires, and insulators are mounted on the wooden bars. In many cases such an arrangement has been called for by railway companies whose lines are crossed. In Italy power companies have been compelled to throw lattice box-girders across railway lines and to carry the wires inside them.

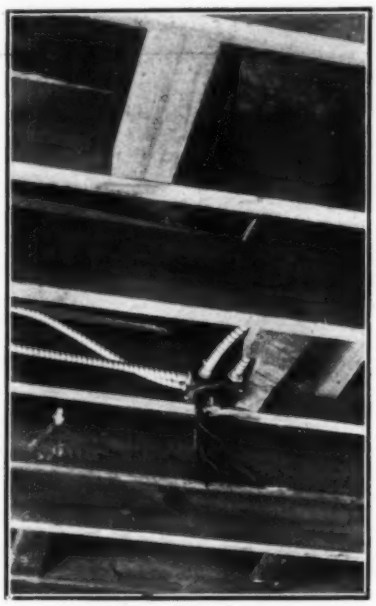


Fig. 5.—Showing Rigid Conduits and Armored Cables.

But it appears that in Italy the cradle and its modifications was first abolished. The construction known in some parts of Europe as the "Italian crossing" recognizes that the insulators, and not the wires, are the weak points. Guido Semenza has long ago pointed out that a span of hard-drawn wire is the simplest and most perfect engineering structure. The Italian crossing consisted in duplicating the insulators and providing duplicate conductor wires, carrying them for a metre or so beyond the span of the crossing, and binding or clamping them to the main wires at the ends and at intervals on the crossing.

But it is a mistake to suppose just because two wires are run side by side and are bound together, that any additional safety is secured. The stresses on the wires may be as great as ever, facilities for lodgment of snow are increased, and the wind load on the poles is doubled.

Writing to an English engineer on the subject, Guido Semenza points out that when we build a steel bridge we calculate that it will carry a certain load with a certain factor of safety, and we do not provide a second bridge to keep up the first one if it breaks. Why, therefore, do it for a wire? The breaking stress of a wire can be ascertained with great exactness, but the strength of insulators cannot be foreseen.

The new method is to duplicate the insulators. This may generally be done by slightly increasing the length of an arm and providing a second insulator close to the first. The main conductor wire is run through, and a second wire, bound or clamped as usual firmly to the second insulator, reaches three or four feet in both directions, and is securely whipped or clamped to the main wire. Were this all, a breakage of the main wire under the normal working stress at the insulator would throw the load with a jerk on to the second wire. It is clear, therefore, that the second wire should share the pull under ordinary circumstances, not only thus relieving the main wire of half the load, but being ready to take up the other half in case of failure.

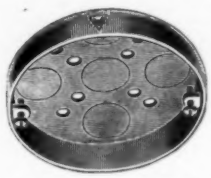


Fig. 6.—Ceiling Outlet Box.

The method of attachment of the ends of the second wire needs some attention. If screw clamps are used, care must be taken that they do not nick the wire. If the joint is made by tight whipping, and is found to take its share of the load, which is proved by the pulling of the main wire out of the straight line, it will probably hold if the whole stress comes on it.

In the crossings first erected in Cornwall the second conductor was carried the full length of the spans, but these were short. By sharing the pull between the wires in such a case it is possible to double the factor of safety. —*The Electrical Times.*

THE INSTALLATION AND OPERATION OF AN AUTOMATIC HOT-JOURNAL ALARM SYSTEM.

By H. G. Wilson.

Much is written regarding the correct installation of power and light wires, but little is ever heard about the methods used for installing signal systems and other systems of a like nature. Generally men have to be specially trained to do this work, as they have to learn that it has to be installed with much more care than is usually given ordinary bell wiring, and that the requirements for insulation, etc., are not as rigid as for power and light wiring. The following is a description of the installation and operation of an automatic hot-journal alarm designed more especially for use in grain elevators and other dusty places, but which is used to some extent also in coal mines. It will probably be of interest to many to whom the idea may be new. The bearings in the plant which the writer has in mind are located mainly on long lines of shafting and are quite subject to overheating, sometimes chronically so, by reason of the shafting being thrown out of alignment by the variation in the enormous weight on the different parts of the elevator structures when the grain bins are filled or emptied. There are also many journals located where it is difficult or sometimes impossible for an oiler to reach them when the machinery is running, and there are other journals, such as elevator boot journals, which can only be oiled through long pipes which sooner or later become clogged with dust, allowing little or no oil to reach the bearings. Even the best of care cannot prevent the bearings, particularly the elevator boots, from becoming covered at times with fine grain dust, saturated with the lubricating oil. The danger from this condition is apparent, the oil-saturated grain dust supplying just so much highly inflammable material for fuel, after the bearings become heated beyond the danger point, and it is astonishing how many journals are dangerously hot and yet escape notice. One of the first results of the installation of an approved journal-alarm system in a grain elevator is the discovery of many warm bearings never before suspected of being in any way dangerous or out of condition.

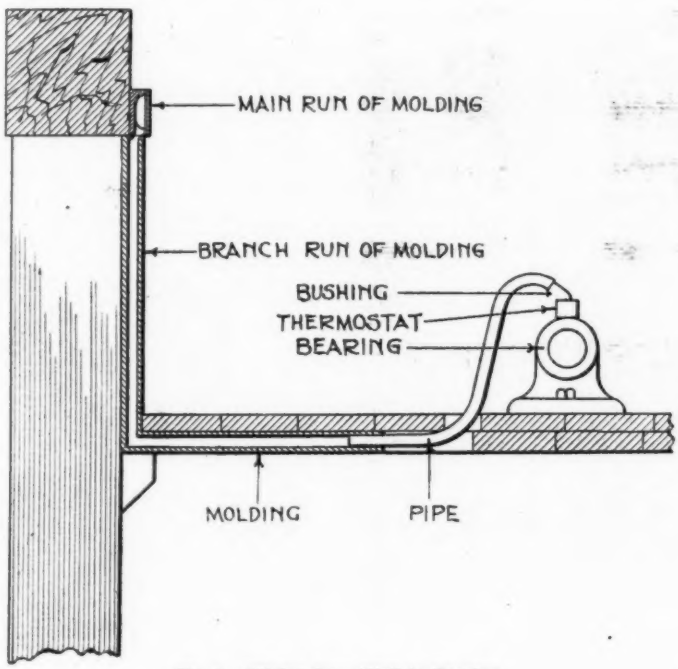


Fig. 1.—Wiring from Wall to Bearing.

The system of wiring as shown in Fig. 4 for the thermometer and alarm bell is operated by a primary battery, the number of cells varying with the number of bearings equipped, the distance to them, etc. Number 16 cotton-covered or braided wire is used, and run in molding having a cross-section such as shown in Fig. 2. The size of the groove varies with the number of circuits, as it is permissible to place all the wires of the system in the one molding. The batteries, automatic testing and indicating mechanism, usually called the "clock" (Fig. 5), are located in the engine room of the plant, and from there circuit wires controlling 24 bearings, or fewer, are run in the molding where protected, and when exposed to the weather they are cabled, weatherproofed and then fastened with cleats to walls or whatever other supports may be available, to the different floors where the circuits end at their respective locations in switch boxes which contain a series of what are called "finding" switches, that subdivide the circuits for

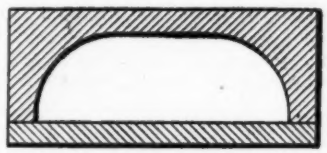


Fig. 2.—Section of Molding.

24 bearings into groups of from four to six. Usually one box is sufficient for each floor, but when there is a large number of bearings, and when the floors are larger than usual they are divided into sections and boxes placed in each for the greater convenience in locating bearings. From the switch boxes the wires are looped to each bearing, which is drilled with a hole five-eighths inch in diameter and one-half inch deep for the reception of the thermostats (Fig. 1). Collars are fastened to the bearings when they are not sufficiently thick to drill to the required depth. A small hole is also drilled and tapped at an angle to the five-eighths-inch hole for a setscrew which keeps the thermostat from jarring loose.

Fig. 1 shows the method used to reach the bearings. From the main run of molding, three-eighths-inch pipe bent as shown is used with reducers on each end for the reception of hard rubber bushings. A petticoat (Fig. 6) is then soldered to the flexible rubber-covered wire which is used in the pipe work, leaving enough slack to allow room for handling the thermostat, which has to be removed when once it is fused.

This completes what might be called

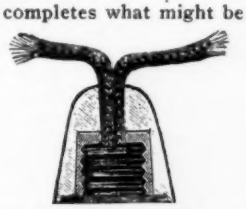


Fig. 3.—Section of Petticoat.

the outgoing side of the circuit, when the thermostat is screwed into the petticoat and then placed in the bearing. A continuous ground wire is run from the "clock" to each length of shafting in the building and to each switch box, where a loop is left for testing purposes; this completes the return side of the system.

Where bearings are located on movable machinery, such as on "trippers," etc., a track is laid on the floor, connection being made between it and the machines by means of specially designed shoes, and when movements of but a few feet are required, as in the end bearings of conveyor belts and boots, a piece of reinforced drop cord is used to give the necessary slack to allow for the adjustment of belts.

A few words showing the paths of currents operating the signalling apparatus will doubtless be of interest to the reader. It should be noted, in the first place, that that part of the

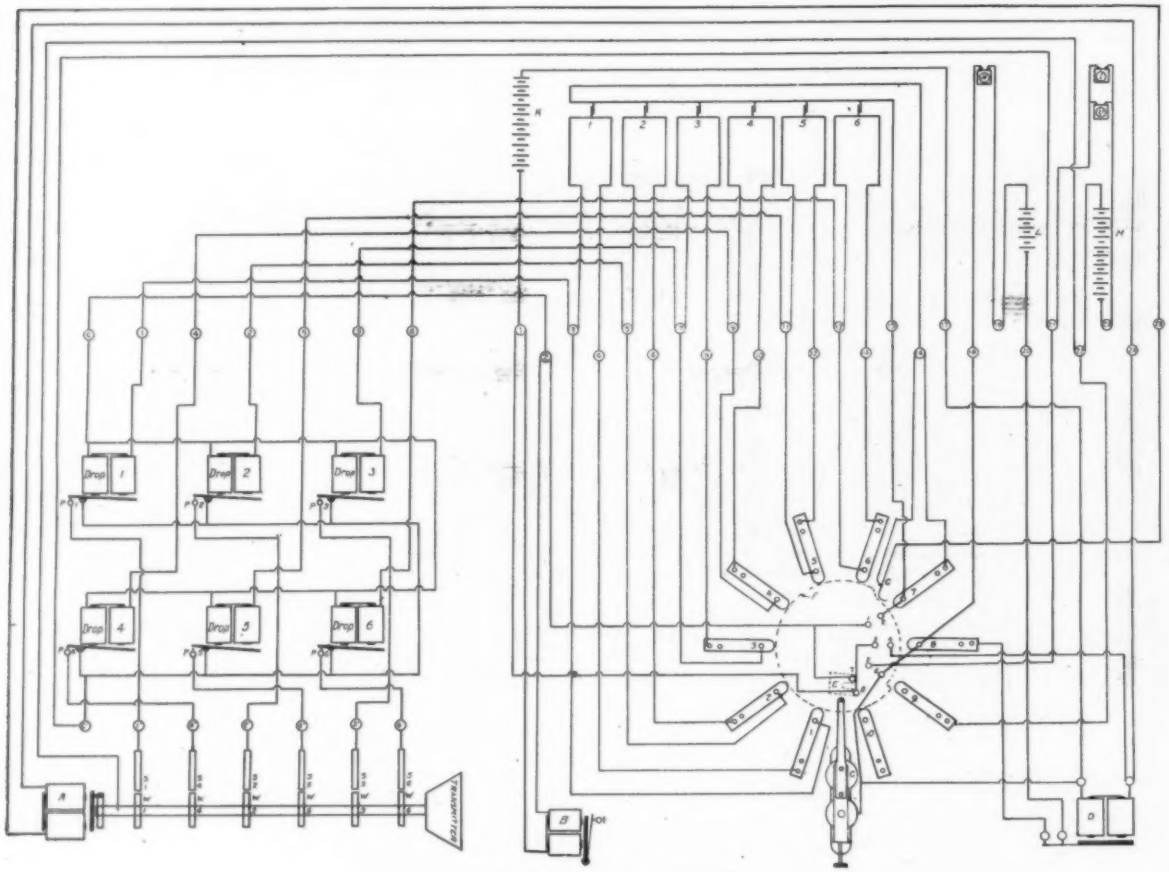


Fig. 4.—Diagram of Alarm Circuits.

lower right-hand corner of Fig. 4 in which there are ten radial arms marked *1* to *10* and all pointing toward a common center, is a diagrammatic representation of the mechanism shown in the right-hand side of Fig. 5. This mechanism is operated by clock drive and is used for testing the alarm system. It is started by releasing a catch manually.

The appliance marked "Transmitter," in Fig. 4, is likewise driven by clockwork, but is set going by the action of electromagnetic release *A*. This transmitter is seen in the left side of Fig. 5. The transmitter is essentially a horizontal metal shaft having mounted on it wheel contacts *W, W, W,* which move under the contact fingers *S, S, S*. Wheel *3*, for example, sounds the alarm for bearings on the third floor or in Group 3. This wheel is made up of alternate portions of conducting and non-conducting material so arranged that when the alarm for this floor or group of bearings is sounding, there will be three rings and a pause, three rings and a pause, continuously until the attendant's attention has been called and he has opened the bell circuit.

Battery *K* starts the transmitter. The gaps between the short vertical lines projecting upward and downward above points *1, 2, 3,* etc., near the top of Fig. 4, are closed by the action of the thermostats in the bearings which the alarm system protects. If, for example, any one of the bearings in the group of bearings marked *1* becomes excessively hot, the melting of the fusible material in the thermostat of the hot bearing causes this thermostat to establish an electric circuit across the gap above the point marked *1* in Fig. 4. Current then flows from battery *K* and starts the transmitter rotating. It also operates Drop 1 and closes the circuit at *P* just below the drop. The path of the current is out from the lower side of *K*, downward through point *E*, from *E* upward to point *2*, which is nearly vertically below battery *K*, thence to the left through Drop *1;* from here the current flows upward and to the right to the point marked *3*, below battery *K;* then across the closed gap above *1*, and to electromagnet *A* by way of *15-7-C-25*. From *A* the current returns to the battery through conductor 24, electromagnet *D*, and conductor *17*.

As soon as the current whose path has just been traced is established, energy begins to be supplied from the lower terminal of battery *M*, also. This current flows through bells *U* and *I* to the horizontal wire under Drops *4, 5* and *6;* thence up to point *P*, under Drop *1;* and, the gap at *P* having been closed by the current from *K*, the current returns to battery *M* through the left sliding contact on the transmitter and the wire shown attached to the transmitter shaft.

Bell *H* in Fig. 4 is in thet room of the engineer, superintendent or other proper official, and the appliance shown in Fig. 5 is in the same room, usually. The drops shown in Fig. 4 are all in

the box of which Fig. 5 is a photograph, and they serve as an annunciator to show the engineer the number of the bearing which has become hot. There are bells like *U* and *I* on every floor, and when a bearing is hot all of these keep ringing the number of the floor on which the hot bearing is until the oiler finds the bearing and stops the ringing by opening the proper switches. The oiler finds the exact location of the bearing in distress by opening one after another of a series of so-called finding switches. The bells keep ringing until the switch whose number corresponds to that of the fused thermostat is opened.

The alarm system described above was manufactured and installed by the Western Fire Appliance Works, of Chicago.

The cotton-covered wire has been found to be reliable under conditions which generally exist in grain elevators and mills, but where dampness or acid fumes have to be contended with, it is necessary to take the same precautions as for the insulation of power and light wires in like locations. All joints are soldered and taped with friction tape only; this is all that is necessary, the wires being cotton-covered.

The bells are all connected to a contact device, shown in the lower part of the left-hand side of the "clock," which causes them to ring a certain number repeatedly until action is taken, which will be explained under "operation," the number corresponding with numbers given to each group of finding switches.

Framed lists having the switch-boxes, their numbers and the location of the groups of bearings are placed beside all the boxes.

In the engine room there is an 8-inch vibrating bell on a separate battery and an annunciator as shown in the upper half of the left-hand side of the "clock" (Fig. 5); each circuit is connected to the magnet whose drop has a corresponding number with one of the circuits.

Operation.

When the bearing reaches 160 degrees Fahrenheit, the temperature at which the thermostats fuse, a spring normally held in compression is released and completes the circuit through the grounded shafting. The closing of the circuit causes the engine, room bell to ring and the fall of the drop for this particular circuit, or the annunciator, thus calling the engineer and showing him what circuit the hot bearing is on, and at the same time causes all the bells on the different floors to ring simultaneously. As soon as the oiler hears the bells he counts the number they ring and goes immediately to the switch box having that number and pulls out the finding switches until he reaches one which stops the bells from ringing; he then replaces the others and refers to the framed list and finds where the bearing is located. On reaching it he removes the fused thermostat, which he replaces with another one when the bearing is cooled again.

A test of the system is usually required every day, provision being made for this in the "clock," shown at the upper half of the right-hand side in Fig. 5. This automatically tests all the circuits and records their condition on a dial.

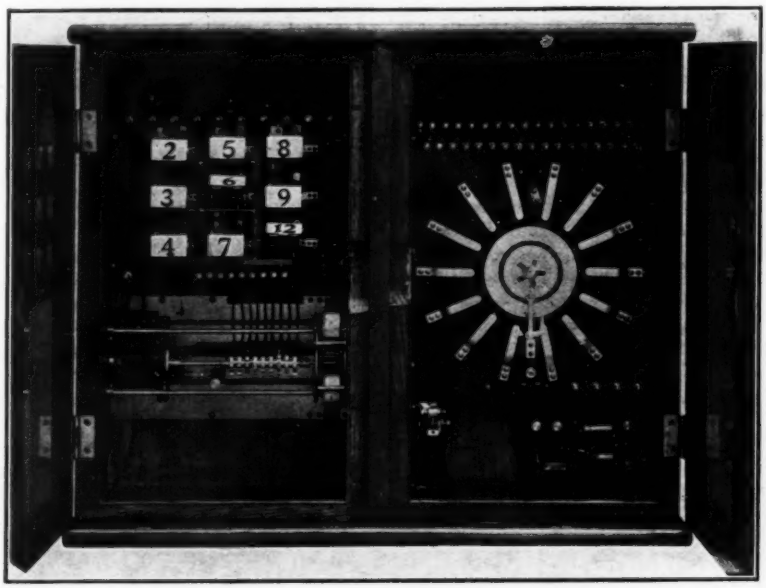


Fig. 5.—Photograph of Transmitter and of Testing Clock.

There have been many bearings equipped in grain elevators alone, and in conjunction with its fire-prevention possibilities, a better insurance rate is allowed for an approved installation; a saving in coal by showing up bearings causing excessive friction is effected, and it also saves costly shut-downs by detecting a hot bearing before the babbitt runs. There are up to the present time over 25,000 bearings equipped in 80 different elevators, mills and coal chutes with this system.

Interesting Changes in New York Electrical Code.

The 1912 edition of the Electrical Code of the City of New York contains a number of important changes in the rules of 1911, several of which are general enough to be of special value to workers in other portions of the electrical field. A summary of the changes follows.

The numbering of the rules is practically the same as that in the National Electrical Code throughout.

Fig. 6.—Complete Thermostat.

The requirement that the holes in which the heads of bolts on the back of a switchboard are countersunk, where the bolts support resistance boxes or equalizers, be filled, has been amended to require the bolt heads to be covered with an insulating compound.

Rule 8*h* of the New York Code has been modified to conform to the latest edition of the National Code.

To Rule 8*f* a clause has been added requiring motors permanently located on wooden floors to be provided with suitable drip pans for catching waste oil.

Into Rule 12*b* a provision has been inserted that wires for services, of No. 6 B. & S. gauge or smaller, must consist of approved rubber-covered multiple-conductor cables, the following parts of the section remaining unchanged.

When light and power wires are placed on the same poles with telephone or other similar wires, the vertical spacing between the two is now

required to be 40 inches instead of four feet as heretofore.

The fourth paragraph of Rule 12*g* is changed to permit twin-conductor lamp leads to be carried down combination poles on insulators.

To Rule 15 the sentence, "The ground on the conduit system is not to be considered a ground for the secondary system" has been added.

Rule 15*a* is changed to read "Neutral wire must be grounded," etc. The grounding of transformer secondaries on distributing systems is also specifically required, provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 320 volts. When no neutral point is accessible one side of the secondary circuit must be grounded, provided the maximum potential difference between the grounded point and any other point in the circuit does not exceed 250 volts.

Companies in charge of water works are urged to allow the attaching of ground wires to their piping systems, and are assured that this will in no way injure the piping.

Not only is the use of single-pole switches as service switches prohibited, but it is also specified that they must not be employed to control outdoor signs nor circuits located in damp places.

The use of wooden molding will not be allowed within the city after June 1, 1913.

To the first paragraph of National Code Rule 38*t*, concerning theater wiring, is added the sentence "Where receptacles are used, they must be inclosed in approved boxes."

The circuit between a moving-picture arc lamp and the service or center of distribution to which it is connected must be of conductors not smaller than No. 6 B. & S. gauge.

Rule 38*u*, paragraph 6, relative to motion-picture machines, states that these machines must be of an approved type. If driven by a motor, they must be of a type designed and approved for such operation. When so approved, motor-driven machines, in charge of skilled operators, may be authorized under special written permission, given in advance.

After the first sentence of Rule 50*j*, which sentence is taken from the National Code, the following sentence is inserted: "There shall be a tape or braid over the bunched conductors except where the conductors are laid parallel and not twisted."

Rule 56*b* and *c* follows the National Code closely, but there is the requirement that the braid covering of duplex wires must be one thirty-second of an inch thick *for wires larger than No. 10 B. & S. gauge, and at least one sixty-fourth of an inch in thickness for No. 10 wires and those smaller than No. 10.*

To Rule 57*b* is added the requirement that if lead-covered conductor is used, the lead must be at least one thirty-second of an inch thick.

Changes in Rule 65*j* relate to the marking of switches, as does also a change in section *k* of this rule.

Cabinets must be deep enough to allow the doors to be closed when the switches in them are thrown open as far as their construction and installation will permit.

Rule 70*c* is changed slightly, so that the present wording is the same as the wording in the National Code, as is also the case with section *d* of the same rule.

Rule 85*e* is amended so as to permit the carrying of both wires of a signaling system through a wall in one bushing.

Among the Contractors.

John H. Lloyd, who was formerly the chief electrician of the Post Office Department, Washington, D. C., is now engaged in the electrical contracting business in the cities of Panama, and Colon, Republic of Panama. He has the electrical contract for the new Masonic Temple being erected at Colon at a cost of $100,000. This is quite an extensive installation for this part of the world, six thousand feet of three-quarter-inch conduit being used, and a $3,000 electrical heating kitchen also being installed, sufficient to accommodate about 250 guests in the banquet hall. The building is of concrete and steel construction.

Mr. Lloyd also has the contract for the electrical installation in a modern American apartment house, which adjoins the Flat Arch located in the ruins of the old church of Santo Domingo built by the monks in the fifteenth century. This Flat Arch has been quite a curiosity to architects and has been bought by the Panama Government for preservation.

The Salt City Electrical Works, which was recently established in business at 316 East Washington Street, Syracuse, N. Y., and of which W. P. Gyatt is manager, has been awarded the contract for the electrical work on the new Sherwood Hotel at Greene, N. Y.

The Conduit Electric Company, of Syracuse, N. Y., has received the contract for the installation of the entire electrical equipment, including transmission lines, for the Benson Mines Company at Benson Mines, N. Y.

The Langdon & Hughes Electric Company, of Utica, N. Y., is engaged in the installation of wiring in the Perry Town Hall in Perry, N. Y. This company is also putting in the electrical installation in the New York Central Railroad shops at Avis, Pa., and is wiring the mills of the Daniel Green Felt Shoe Company at Dolgsville, N. Y.

Former employees of the Indiana & Michigan Electric Company have organized the Co-operative Electrical Wiring and Repairing Company and will engage in business at 136 South Polk Street, South Bend, Ind.

A. S. Schulman, 417 South Dearborn Street, Chicago, has been awarded the contract for installing the electrical work in a large building owned by Alfred Decker & Cohn, in this city. The installation will include 2,000 incandescent lamps and 150 horsepower in motors.

The Elder Electric Company, of Lynchburg, Va., is just completing the erection of a central station at Brookneal, Va. The plant will be owned and operated by the Brookneal Light & Power Company, of which L. W. Rush is president.

A contract for the electrical work upon the new $300,000 home of the Young Men's Christian Association at Third Avenue and Broadway in Louisville, Ky., has been awarded to F. A. Clegg & Company, well known contractors of the Gateway City. F. E. Good is manager of the Clegg company's electrical department. The Y. M. C. A. contract is one of the most valuable of the year. It calls for complete iron-conduit wiring in a seven-story structure of immense area. The building is to be one of the finest in the United States, with dormitories, restaurant and all gymnasium facilities along the most approved lines. The specifications provide approximately 2,200 lamps in the building. The Clegg company will also wire a set of motors providing from 60 to 70 horsepower for the elevators and heating and ventilating systems in the structure.

Three new contracts, aggregating nearly $6,000, have recently been given to the Bland Electric Company, of Louisville, Ky. This company is preparing to install $1,600 worth of conduit wiring in the handsome store now being erected upon property owned by Harry Weissinger at Fourth Avenue and Green Street. It is also working upon an $1,800 wiring job in the new William F. Mayer furniture store. The most important Bland contract in hand, however, is that of wiring the new business headquarters of the Kentucky Electric Company. In this building, because of the widespread demand to be exerted for every sort of electrical attachment known, there is to be every type of wiring standard in the craft. The many different classes of current have necessitated the installation of 110, 220 and 500-volt, two and three-phase wiring.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Device for Making Tests for Open Circuits and the Like.

I recently read a description of the wiring of a test lamp which interested me very much—especially so since I had been using a somewhat similar device for about two years. I feel, however, that my device is an improvement on the one described.

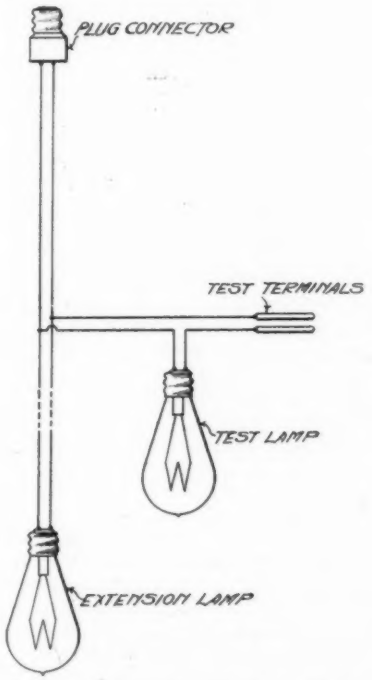


Fig. 1.—Arrangement of Lamps and Test Plugs.

I find it desirable, usually, to have a light burning continuously where one is testing an electrical appliance for faults of any sort, and I accomplish this by using the arrangement shown in Fig. 1.

The pendant lamp burns all the time, of course. If the test points are placed on opposite sides of a short-circuit, the test lamp also burns, while if the terminals are placed across an open circuit, the failure of the lamp to burn indicates the existence of the open circuit.

My cord is made up just as is any ordinary extension cord, and the test cord is attached to it about five feet from the pendant extension lamp. The test cord is about five feet long and the test lamp is placed a foot or so from the end of it. I use finishing nails for the test points, soldering the cord to them, and tapering the splices extra heavy, so as to make them convenient for handling.

This is a very convenient device for testing out a commutator or for examining any coil for open circuits.

L. L. Long.

Plugging Up Gas Outlets.

The method of plugging up gas outlets recommended by Charles A. Bergen in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for September 7 is a good one, but I think I have a better one. I use a blind insulating joint instead of the plug with which Mr. Bergen recommends that the open end of the pipe be stopped. Thus not only is the pipe plugged up, but a support is provided also for hanging an electric fixture.

Charles Lendman.

Pulling Duplex Into Conduit.

Often in installing conduit work the electrician finds many short runs of pipe through which the duplex conductor cannot be pushed in the usual way, without great difficulty. In cases of this sort much time can be saved by taking the small blade of a knife and making a hole in the insulation of the twin wire about an inch from the end of it, and putting the hook of the tape through this hole. Thus the conductor may be pulled through any ordinary run very readily, as the hole will not pull out on such a run. My experience is that this sort of work is from three to five times as fast as the ordinary scheme of peeling the wires and making a loop for the hook on the end of the tape.

E. N. Henshaw.

Driving Nails Without Splitting Boards.

To avoid splitting the timber when driving a nail near the edge of a board, cut off the point of the nail with side-cutting pliers. Such a nail will punch rather than wedge its way through, and may be driven almost on the edge of the board without splitting it. It is a very useful trick in replacing trim and moldings.

Roger Mason.

Fishing Loom.

In pulling loom in on a fish job it will go in a good deal easier if a thimble bushing such as is used on B X cable is put on the end of the loom. This thimble has rounded edges and will slip through holes and around corners very easily. When the loom is in, the thimbles can be taken off and used again.

E. W. Dullea.

Drilling Porcelain Enamel.

The following is a simple, but what may sometimes prove to electricians to be a very valuable method of drilling holes in porcelain enameled steel. Anyone not familiar with the work will find the porcelain to crack and chip off as fast as blows are applied. Therefore the necessity of an accurate method.

Around the place where the hole is to be, place a wall of wax into which pour hydroflouric acid, so that it can act on the enamel. Let this stand for eight hours, then wash off with water and the enamel will have been all eaten from the exposed place. With the regular drill the hole can then be easily drilled through the steel.

William Dower.

Convenient Bell Control.

Some time ago, it was found necessary to install a bell on the upper floor of a residence which would replace two bells for the rear and front entrances which were already installed down stairs, so that they would work independently when desired and that the third bell would respond to either the front or rear switch without affecting the two bells already installed. The writer devised the arrangement shown in Fig. 2, which has been used continually for some time. The same general arrangement can doubtlessly be applied to various similar problems.

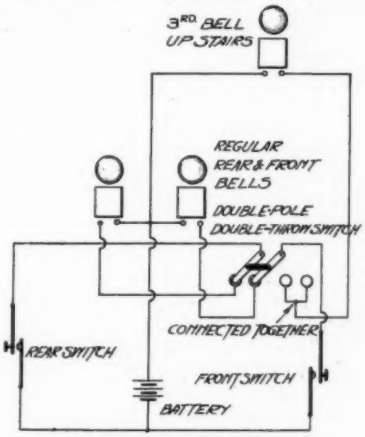


Fig. 2.—Layout of Bell Circuit.

The third bell operates independently from the others.

This arrangement is intended for use when the owner is upstairs, or the maid is upstairs, so that the call will be heard. Ordinarily the regular bells could not be heard plainly upstairs. It is particularly useful at night when the family is on the upper floors. When the regular bells are wanted the switch is thrown as shown. Before going up stairs for any length of time the maid or owner throws the double-pole, double-throw switch to the right, so as to make contact with the two studs connected together.

Philip Edelman.

Public Service Commissions

NEW YORK.

The Public Service Commission, Second District, has directed the receivers of the Ithaca Street Railway Company to resume the operation of street cars on the Cayuga Heights line of the Ithaca Street Railway Company upon the same schedule that was in operation prior to the discontinuance of service on July 5, 1912, with leave, however, to apply to the Commission at any time for a modification of the schedule then in effect. The receivers of the Ithaca Street Railway Company abandoned service upon the Cayuga Heights line, after having operated it for six months as receivers. Answering an order made by the Commission to show cause why service should not be resumed upon the line, the receivers contended that the Cayuga Heights line was not the property of the Ithaca Street Railway Company, but was leased from the Ithaca and Cayuga Heights Railway Company at the time its construction was completed, and that the order appointing the receivers provided expressly that they should have six months in which to investigate the question of any lease that might be held by the Ithaca Street Railway Company, as lessee, and in which to exercise their option as to whether they should continue to act under the lease or should decline to proceed further. The receivers tested out the operation of the property for six months, and reached the conclusion that the longer operation of this piece of track was a great burden upon the balance of the property and they were not justified in continuing operation.

The Commission held that the receivers were not acting within the powers conferred by the order appointing them, in discontinuing operations over the Cayuga Heights line, as a leased line, in view of the fact that the line had been in the possession of and operated as a part of the system of the Ithaca Street Railway Company for several years immediately prior to the abandonment, and the Ithaca Street Railway Company retained in its possession the rolling stock and rails of the Cayuga Heights line and has since been using its cars on the line of the Ithaca Street Railway Company, which is also the owner of all the capital stock of the Ithaca and Cayuga Heights company and has described the identical property in the mortgage which is being foreclosed under which the receivers act.

The Commission, in an opinion, discusses its relations with receivers of street-railroad corporations, and states that the whole scope and intent of the law seems to place the receivers of a railroad in the precise position of the railroad itself. so far as regulation by the Commission is concerned. It is pointed out that they are mere custodians of the property, appointed by the court to preserve it and to operate it, and that it is the duty of the Commission to see that all street-railroad properties under its supervision shall be operated in the interest of the public, proper accommodations afforded and proper service given. The Commission further states that considering the number of leased lines of railroad within the state, the frequency of receiverships, the manifest inconvenience to the public which may be created by entrusting the power of discontinuing service to mere custodians of property without any regulation or supervision whatever, considering the intent of the Legislature to subject all operations of railroad corporations as to the character and extent of service to the Commission, it is convinced that the proper construction of the Public Service Commission Law is that the right of the receiver to discontinue service upon leasehold property described in the mortgage and committed to his care by the order of the court, must be exercised subject to the power of the Commission.

The Commission has authorized the Peoples Gas & Electric Company to exercise a franchise granted by the town of Oswego to furnish electricity for light, heat and power in that town.

OHIO.

The Public Service Commission last week granted permission to the Northwestern Ohio Railway Company to issue $105,000 in bonds. This assures the immediate improvement of the electric line between Toledo and Lakeside. About $100,000 of the issue will be used to increase power facilities and the balance to purchase additional cars for the system.

CALIFORNIA.

The Commission has rendered a decision granting to the Santa Barbara Gas & Electric Company permission to sell $5,000 of bonds.

The Big Four Electric Railroad Company, of Tulare County, was given permission to sell 100,000 shares of its capital stock of the par value of $100,000, for the purpose of building an electric railway in Tulare County, 34 miles in length. The company is required to raise from stock $50,000 before prosecuting construction work.

Announcement was made that the Commission had in preparation a general order requiring all public utility corporations to preserve all records.

The Commission rendered a decision authorizing the sale of the Southern California Mountain Water Company to the city of San Diego on the following terms: portion of plant for $2,500,000, the balance under lease for ten years at $67,500 per annum, with option to purchase at $1,500,000.

MASSACHUSETTS.

The Massachusetts Railroad Commission has granted the petition of the Springfield Street Railway Company to act as common carrier of baggage and freight in the town of Ludlow, Mass.

The Commission has authorized the Athol & Orange Street Railway to install, in certain of its cars, the Peter Smith hot-water heater for the purpose of experimenting with this method of heating cars. This authority is to continue until revoked.

NEW JERSEY.

The Board of Public Utility Commissioners has issued a pamphlet containing the report and recommendations made by its chief inspector regarding rates of telephone companies. A copy has been sent to each telephone company operating in the state and a conference will be held at Trenton on October 9.

A pamphlet containing proposed rules and regulations for service supplied by electric companies has also been prepared and a copy sent to each electric light and power company operating in the state. These proposed rules and regulations will be the subject of a discussion at a conference to be held in the State House at Trenton on October 16.

Illuminating Engineering Society.

Sixth Annual Convention, Niagara Falls, Canada, September 16-19.

The sixth annual convention of the Illuminating Engineering Society was held at the Clifton Hotel, Niagara Falls, Ont., on September 16, 17, 18 and 19. While the attendance at this convention was not as large as at the previous conventions, which, with one exception, have been held in cities which are the centers for geographical sections, it was, nevertheless, in all other respects one of the most successful which has been held. The total registration was 130, of whom 51 were guests. The first session was held on Monday morning, September 16, with President Van Rensselaer Lansingh in the chair. This session was taken up with addresses of welcome by O. E. Dores and G. F. Nye, presidents of the Boards of Trade of Niagara Falls, Ont., and Niagara Falls, N. Y.; a response on behalf of the Society by William J. Serrill, the presidential address by V. R. Lansingh, and reports by the Committee on Progress and the Committee on Nomenclature and Standards, as reported in our last issue.

The afternoon session was opened with a paper by R. F. Pierce, entitled "The Deterioration of Gas-Lighting Units In Service." This gave the results of an extended series of experiments showing the change of candlepower during the life of incandescent mantle lamps. Thirty-six inverted units were under observation for 5,000 hours. The effects of intermittent service were studied. It was found that the total deterioration of 15 per cent in 1,000 hours could be assigned as due to the mantle alone, 2.5 per cent; burner alone, 2.5 per cent; and glassware alone, 10 per cent.

The discussion was opened by C. O. Bond, who told of the work he had done in taking microphotographs of a mesh of mantles in order to determine the mechanical change that accompanied deterioration. The cotton-base mantle, at the end of 3,700 hours appeared frazzled, while at the end of 6,800 hours a ramie mantle was but little changed, and a mantle of artificial-silk base showed no change whatever.

Ralph Beman referred to the changes in color at different periods in the life. In one case which he had examined the green component increased 28 per cent. Color is thus a criterion of age.

Ward Harrison stated that the average variation of voltage had been found in Wisconsin central stations to be three per cent on either side of the normal. He referred to the relative depreciation of gas and electric lamps and stated that the Consolidated Gas Company in New York had found a depreciation of 30 per cent.

A symposium on "High-Pressure Gas Lighting" followed. George S. Barrows read a communication from F. W. Goodenough, of London, England, outlining the progress made with high-pressure lighting in Great Britain and giving historical references on lamp development. There are 12,000 lamps of 1,000 candlepower now in use in London. Mr. Barrows also read a communication from Oscar Klatte, of Berlin, Germany, discussing conditions in that country. R. N. Zeek summarized the conditions in this field in the United States. The discussion was participated in by W. J. Serrill, C. A. B. Halvorson, A. J. Marshall, H. H. Magdsick, E. L. Elliott, G. S. Barrows, R. B. Hussey, T. L. George, R. F. Pierce and H. T. Owens. The discussion brought out the fact that the price of gas is less in Europe, but it is also of a poorer quality, than in the United States, that the mantle life has been raised from 10 days, which has been the average in England, to 45 days, and that gas would have to be sold at 40 cents to give a maintenance cost as low as the luminous or long-burning flame electric lamps.

In closing the discussion Mr. Barrows stated that neither the Keith nor Graetzen lamps are suited to weather conditions in this country, but that lately a lamp has been developed which gives satisfactory performance. Lamps would have to be trimmed once a week.

The session on Tuesday was opened with a paper by Edward P. Hyde entitled "The Methods of Research." This discussed not only the methods to be followed in planning an investigation, but the process of reasoning by which conclusions are deduced from observations. The haphazard method was contrasted with that in which a definite scheme is followed. A general plan of procedure for carrying on any investigation was proposed.

This paper was discussed by C. H. Sharp, H. E. Ives, P. S. Millar, D. M. Moore and E. L. Elliott. Dr. Sharp spoke in appreciation of the paper and the application of the ideas to problems in illumination. It is in the psycho-physiological field especially where personal peculiarities must be eliminated from the observations. It was suggested that investigators should submit their plans to the Research Committee before carrying out their work.

H. E. Ives then presented his paper on "Heterochromatic Photometry and the Primary Standard of Light."

Heterochromatic Photometry and a Standard of Light.

Five requirements should be met by an acceptable method of heterochromatic photometry: (1) the results should correspond as nearly as possible to some useful value; (2) the method should have high sensibility; (3) the results should be accurately reproducible; (4) things measured equal to the same thing should measure equal to each other; (5) the sum of the measured values of the parts should equal the measured value of the whole. Four methods were studied, namely, visual acuity, critical frequency, equality of brightness and flicker. All were eliminated except the flicker method, which was found to be the most suitable, although the method of equality of brightness has some advantages. It is recommended that the flicker photometer be adopted as standard; that it be used with an illumination of 25 meter-candles; that a photometric field of a diameter of two degrees can be surrounded by an equally bright area of 25 degrees in diameter; that the observer have an average eye. The latter condition has been determined by measurement with 18 different observers. The photometry of lights of different color should be confined to the standardizing laboratory, commercial measurements being made with standards of the same color as the test object. For a primary standard of light the author recommends a unit defined in terms of radiant energy of the greatest possible efficiency, that is, consisting of monochromatic light of the wave-length to which the eye is most sensitive. He proposed as this unit the luminous flux from a source radiating energy of maxium luminous efficiency at the rate of one watt.

The discussion was opened by R. B. Hussey, who favored action on the proposals made. H. P. Gage referred to the application of this work in railway signaling.

F. E. Cady told of independent measurements which have been made in two laboratories on blue glass with a difference of only one per cent. This showed that the practical realization of the average eye was not a difficult matter.

In closing, Dr. Ives stated that the differences obtained with different commercial flicker photometers was due to different conditions of use. They could be used down to three or four meter-candles without trouble from the Purkinje effect, unless the colors were widely different or high accuracy was required; in any case to seven meter-candles.

A paper by P. G. Nutting entitled "A New Method and an Instrument for Determining the Reflecting Power of Opaque Bodies" was then presented, in the absence of the author, by Loyd Jones, who exhibited the instrument in question. It consists of two parallel plane surfaces; one of which is a diffuse illuminator and the other the sur-

face whose reflecting power is to be determined. The relative brightness of the two planes is then the reflecting power of the nonluminous plane. A polarization photometer is inserted between the two planes to determine the relative brightness. The glass wedges in the end of the photometer tube increase the angle of the entering beam. Values are given for a number of substances.

This paper was discussed by C. O. Bond and L. J. Lewinson.

In closing, Mr. Jones, in answer to questions, stated that the dimensions could be altered for practical application and the instrument could be applied to measurements on walls, etc. It had, however, been devised for use in measuring reference standards.

M. Luckiesh then presented a paper entitled "A Study of Natural and Artificial Light Distribution in Interiors."

Distribution of Light in Interiors.

The author has studied the distribution of natural daylight and of both direct and indirect illumination in three rooms of different shapes and outlook. Readings were taken with a Sharp-Millar photometer at various angles in a vertical plane and curves of distribution are given for different test stations in the rooms. The ratio of upward to downward light was also determined and plotted in curves. The percentage of diffused light and the illumination uniformity factor have been calculated. The latter is defined as the ratio of the mean illumination about a point in one plane to the maximum illumination. Illuminating efficiency is frequently defined as the ratio of the effective lumens on a horizontal test plane to the total lumens generated. Some better method of comparing systems should be devised. The distribution of brightness with natural and direct lighting in rooms with dark and light walls was measured and the results shown by curves. The author draws the following conclusions.

The measurement of illumination on a horizontal plane does not give a fair comparison of illuminating efficiencies. The distribution of illumination in various planes is of considerable importance when comparing various systems of lighting. The uniformity of the distribution of light about a point under natural lighting conditions in interiors is not as great as is sometimes assumed and is often less than that obtained by direct or indirect lighting. Unless the room has windows on more than two sides it is likely that indirect lighting will always show a greater degree of diffusion and a greater illumination uniformity factor about a point than natural interior lighting. While extended sources assist in diffusing light, even a greater illumination uniformity factor is obtainable by a distributed direct system. Extended sources are advantageous in eliminating sharp shadows and glare from glazed paper and polished objects. The great difference in the ratio of upward to downward light for natural and artificial lighting may partly account for the greater desirability of the former in many cases, especially in industrial lighting. Daylight entering a room through windows is to a considerable extent incident upon the walls, producing a distribution of brightness more nearly that obtained by direct artificial lighting. At least this result was obtained in rooms of extreme types and other observations indicate this similarity to be somewhat general. It is possible to artificially imitate the distribution of daylight in a room with pleasing effect and with an efficiency not prohibitively low.

The discussion was opened by J. R. Cravath, who pointed out the application along esthetic and utilitarian lines. The use of the diffusing screen detracted from the value of the method. The amount of glare from the paper is not shown.

A. J. Sweet spoke of the importance of diffusion and stated that daylight interior lighting should not be copied. Daylight had only two good qualities, diffusion and color. The popular impression that it was the ideal illumination should be corrected.

F. A. Vaughn agreed with the previous speaker, but thought a third good property of daylight was its cheapness.

In closing the discussion, Mr. Luckiesh stated that artificial lighting can often be made better than daylight, but he had seen many instances of excellent lighting by daylight.

The session on Tuesday afternoon opened with a paper by E. L. Elliott entitled "The Determination of Illumination Efficiency."

Illumination Efficiency.

Mr. Elliott opens his discussion with a consideration of what illumination is. Qualitatively speaking, that illumination is the most efficient which permits the eye to perform its function with the least strain and effort. The most obviously measurable quantity for determining this is the intensity of illumination which, if other things are equal, is a measure of the efficiency of lighting. Usually this is determined by finding the horizontal illumination on a plane 30 inches from the floor. However, Mr. Elliott considers that this introduces many errors because in relatively few occupations is horizontal illumination only of value. In reading, drawing and writing the most comfortable position is to have the object at right angles to the line of vision; moreover, a lighting installation may be made that will give very high horizontal illumination but practically no vertical illumination, but this would be far from desirable for general use. It seems, therefore, that it would be desirable to measure not only the horizontal illumination, but to measure all illumination, no matter in what direction it is received, that is useful in visualizing the object.

Left Half—Group at Convention of Illuminating Engineering Society.

M. Luckiesh agreed with the author that no one measurement could be sufficient to determine the adequacy of any installation.

A. J. Sweet advocated the present general practice of leasuring lumens upon a horizontal plane 30 inches above the floor level, and taking the ratio of this to the total lumens emitted by the source as the efficiency of the illumination. When the illumination is adequate on the horizontal plane it is usually adequate upon other planes.

P. S. Millar considered it sufficient to measure the illumination upon plane surfaces since these are the kind which are most often viewed.

C. O. Bond compared the author's scheme with Ryan's illuminometer.

E. L. Elliott in closing the discussion insisted that most of the objects viewed

in any room have relief and are not plane surfaces, and, moreover, are viewed from different positions.

The next paper, by P. G. Nutting, was entitled "The Diffuse Reflection and Transmission of Light." It was presented by Loyd Jones. The author considered the three types of diffusion required, namely, (1) transmission with maximum diffusion and minimum absorption; (2) diffuse reflection with both reflecting power and diffusion a maximum; (3) diffuse reflection with high reflecting power and with the reflected light massed within a given angle, as with aluminum paint. The properties of materials which would give them these qualities were considered and a number of materials mentioned which have the various properties. The theory of diffusion was then worked out in its application to several particular cases.

This paper was discussed by C. H. Sharp and M. Luckiesh. The latter presented some experimental results along the same line as the author. Ground and etched glasses give selectively diffuse transmission, the curve of distribution being elliptical. Opal glass gave almost perfect diffusion. Alba glass gave semispecular transmission; that is there was some general diffusion as with opal glass combined with a strong component in one direction. Lucida glass was similar to ground glass but the curve was very flat.

The next paper by Percy W. Cobb, entitled "Vision as Influenced by the Brightness of Surroundings," was then presented by M. Luckiesh. This paper was a condensed report of some experimental work by the author to determine the influence of bright surroundings of the object viewed upon vision. Experiments were made upon visual acuity as determined by the closeness of lines which could be detected and upon difference in brightness which could be detected. With illumination up to 10 candles per square meter a dark background surrounding the object was found to assist vision. With more intense illumination, especially above 42 candles per square meter, which was the intensity of the illumination upon the surrounding field, it was found that this field assisted vision slightly.

H. P. Gage suggested that the question of focussing the eye might have some influence upon the results. He referred to the fact that monochromatic light gives higher acuity and suggested similar experiments using colored glasses. He referred to the fact that a red signal lamp can be seen at a greater distance upon a train than a green one. He had found, however, that by using a negative lens in front of the eye, thus making it far sighted, the green could be seen farther than without it.

A. J. Marshall had also noted that the red lamp could be seen farther, but upon inspecting it found that it was 25 per cent larger than the green lamp.

E. L. Elliott stated that greater acuity resulted from flashing a light into the eye, but this was of brief duration and fatigue acted quickly. He thought the author should have considered the effect of fatigue.

H. E. Ives had found in color photometry that the sensibility was increased by having the surrounding field of equal brightness. The eye is fatigued by looking through a dark tube at a bright object.

L. B. Marks compared the results with practical experience. Systems of local illumination had not been found good. A dark background in factory work had been found to produce fatigue. The field as well as the work should be moderately illuminated.

A. J. Sweet and J. R. Cravath also joined in the discussion, which was closed by Mr. Luckiesh.

E. L. Elliott then presented a paper entitled "A Proposed Method of Determining a Coefficient of Diffusion for Translucent Media."

Diffusion of Translucent Media.

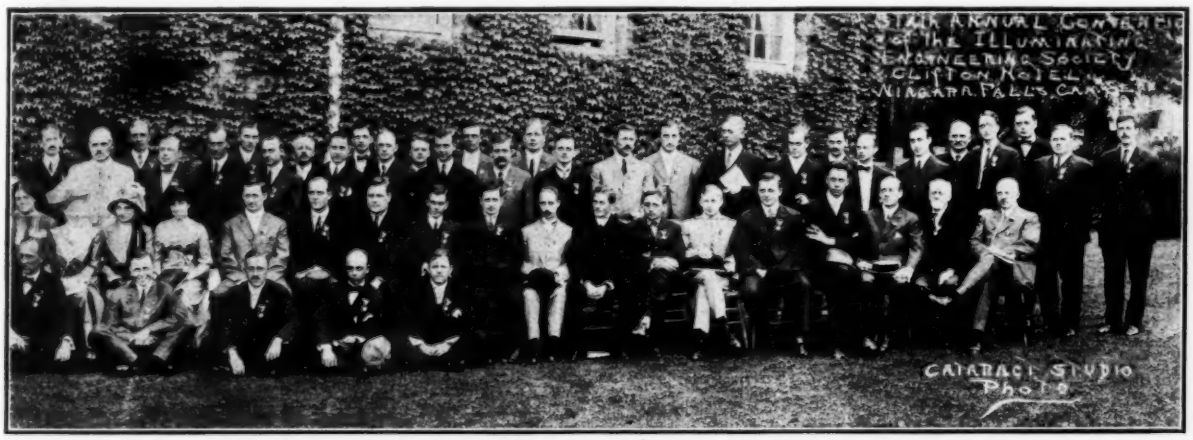
In this paper Mr. Elliott at first discusses the meaning of diffusion. Diffusing media, such as globes, shades and reflectors, are means by which the number of directions of rays traversing any given space is increased. It is desirable to have a method by which this diffusing power may be expressed as a simple coefficient. If a lamp be placed within a sphere whose inner surface is perfectly matt white, every portion of the surface is uniformly illuminated and the light is perfectly diffused. If such a globe were translucent, it would appear equally luminous over its entire surface when viewed from without. The diffusing power of such a globe may therefore be considered as being unity, or 100 per cent. By contrast, a clear-glass globe has zero diffusing power. If the point of lowest brilliancy on any globe is one-half that of the highest point, the globe may be regarded as having a diffusing power of 50 per cent. Therefore, by measuring the maximum and minimum surface brightness of the globe and expressing the numerical ratio between these intensities the coefficient of diffusion is obtained. Mr. Elliott outlines the methods in which this may be measured. Such a coefficient of diffusion together with the coefficient of absorption gives complete and definite information as to the value of any diffusing globe. The practice of giving distribution curves is now becoming general among manufacturers of lighting accessories. The furnishing of the coefficients of absorption and diffusion should become equally general.

This paper was discussed by A. J. Marshall, F. A. Vaughn, A. J. Sweet, A. L. Powell, Thomas W. Rolph, F. N. Morton, C. H. Sharp, C. O. Bond, H. P. Gage, V. R. Lansingh and L. B. Marks. Opinions varied as to the practicability of the method and the manner in which it should be applied.

The next paper was by Claude W. Jordan and was entitled "Some Reflecting Properties of Painted Interior Walls."

Reflecting Properties of Painted Walls.

Painted walls have advantages of a sanitary nature over walls covered with paper. Usually light colors are selected. Measurements have been made of the re-



Group at Convention of Illuminating Engineering Society—Right Half.

flected light from a variety of walls of different color and different surface conditions. The source of light was an incandescent gas mantle of known candlepower. The light falling upon the test surface through a circular aperture was computed and the light reflected from the wall in different directions measured. Both flat and glossy surfaces were tested and a number of curves are given showing the percentage of reflected light in different directions and for different angles of incidence. Flat white paints give fairly good diffusion with an average reflection of 63 per cent. With glossy paints there is considerable specular reflection of light of the same color as the source while the diffused light is in general dependent upon the color of the paint. Distribution curves are also given of the reflected light in a plane at right angles to the plane of the incident rays. With a flat-finish paint this is approximately the same as in the other plane, but with a glossy paint the results are quite different. The physical characteristics of wall surfaces were also considered and experiments made with both smooth and rough finish. A table is given showing the percentage reflection with paints of various colors on smooth walls with light at different angles of incidence. The amount of diffusion in the incident light was found to have no effect upon the results.

This paper was discussed by F. A. Vaughn, W. F. Little and T. W. Rolph.

Wednesday Session.

The session on Wednesday morning opened with the report of the Illumination Committee of the Association of Iron and Steel Electrical Engineers, of which C. J. Mundo was chairman. It was presented by G. H. Stickney.

Steel-Mill Lighting.

The report of the Illumination Committee briefly summarizes the work that has been done along this line by the Association of Iron and Steel Electrical Engineers in the past two years. There is an important need among mill engineers for authoritative data whose value may be readily recognized and that may be in such form as to be readily applied. The report discusses the methods for comparing lamps. In this connection the desirability of combining on one sheet the candlepower distribution curve, the horizontal illumination curve, and the deterioration curve, which are required for a complete comparison of lamps, is strongly pointed out. The two methods of laying out industrial lighting installations to secure desired results are discussed. Data on acquired deterioration are needed. The committee recommends that in judging lamp sizes, the mean lower hemispherical candlepower be used in conjunction with the average inherent deterioration of the lamp during the life or trim; that the illumination curve for the height at which the lamp must be used be employed to check the evenness of the illumination and the utilization of the light; that manufacturers be encouraged to submit candlepower distribution, illumination, and deterioration curves on illuminants, and that these curves give the complete data governing the manner in which they were obtained; that manufacturers be urged to submit constants or spacing tables for the use of their lamps; that illumination tests be encouraged by the members for the purpose of obtaining data on deterioration.

The discussion was opened by Ward Harrison, who referred to the matter of deterioration and frequency of cleaning.

R. F. Pierce referred to the necessity of complete data. Distribution curves do not show the total flux and he advocated a curve in which the radius vector at any point should be proportional to the total flux in a zone of 10 degrees.

V. R. Lansingh stated that he had used such polar flux curves and found them useful, but thought they might be more misleading to the average person than the polar candlepower curve.

A. J. Marshall also joined in the discussion, which was then closed by Mr. Stickney.

This report suggested the relations of the Society to other organizations, and the chairman called upon H. E. Ives, who told of the work which was being done by the Committee on Reciprocal Relations with Other Societies in the way of co-operation. It seemed evident that the work of this committee would result in much good to the cause.

The next paper was by Clarence L. Law and A. L. Powell on "Present Practice in Small-Store Lighting with Tungsten-Filament Lamps." The paper was presented by Mr. Powell.

Small-Store Lighting.

In this paper Messrs. Law and Powell give the results of an extended investigation made on over 800 small stores in and near New York. These were all located on the relatively less important business streets and comprise stores of dimensions in the neighborhood of 20 by 50 feet or less. All these stores were lighted with tungsten lamps and were considered as being typical of what may be achieved in the lighting of establishments of this kind. It was found in nearly all cases that the lighting of the show window increased perceptibly the illumination in the front of the store, because most of the windows were not screened from the body of the store. The three primary factors in small-store lighting are intensity, color and even distribution of light. Intensity must be ample and yet not too great. The color is relatively unimportant because very close color matching is not attained as a rule. Even distribution of the light is quite important. The stores investigated were divided into 20 classes arranged as to the material sold therein. The results of the investigation are as follows: 1. Those stores which demand equal illumination on the wall shelves and counters are best lighted with two rows of lamps with intensive reflectors or one row of multiple-light fixtures with wide arms; if the store is very narrow, one row of lamps is sufficient; this applies to bakeries, china, delicatessen, drug and grocery stores and meat markets. 2. Those stores which demand good illumination on the counters, and a smaller amount of light on the side walls are well lighted by rows of relatively small lamps with intensifying reflectors, providing localized illumination for the counters; such stores are dry goods, cigar, fish, haberdashery, jewelry, pawnbroker and stationery stores. 3. Those stores which demand high intensity on the walls and low general illumination can be lighted by means of small lamps with intensive reflectors located close to the wall, or if very narrow, one row of lamps with distributing reflectors suffices; in this group are art, music, hardware and paint stores. 4. Stores which demand general diffuse illumination usually require decorative fixtures and equipment, or simple units arranged for even illumination; in this class are clothing, confectionery, florist, furniture, novelty, millinery, tailor, shoe, trunk, and wine and liquor stores. 5. Those stores whose illumination is a proposition of localized lighting entirely require special treatment; such stores are barber shops, hair-dressing and manicuring parlors.

The discussion was opened by R. B. Ely, who said that the illumination of the small store was important because taken together they form a large proportion of the load upon any central station. Every storekeeper wants to excel and endeavors to put in what he considers a good installation. This paper includes examples of good, bad and indifferent lighting. In averaging conditions for recommendation he thought that the over-lighted and under-lighted stores should be excluded. If the recommendations were followed it would result in great monotony from the similarity. The values given for a jewelry store, for instance, he considered particularly bad.

A. H. Keleher thought the values of watts per square foot would be very valuable to the contractor. He made a plea for artistic features in fixture installations.

C. F. Stirling, vice-president of the Michigan Section of the National Electric Light Association, spoke of the value of such papers to central-station men and advocated a campaign for enlisting them in the membership of the Society. He thought the Illumination Primer especially would be very valuable to them and that it should be sent to them first of all. Central stations in most small towns found it difficult to convince their patrons of the advantages of really good lighting.

J. R. Cravath said that he had found the small towns to respond to the effort to introduce better lighting. He thought it was usually a question of the example set by the central station in its own lighting and the efforts made by it to push the matter.

Mr. Putnam spoke of the difficulties of getting good photographs of illumination subjects, due to the halation and to the fact that plates sensitive to blue must be used and that the results could be improved by using panchromatic plates and a two-solution developer, weak alkali being used first. It is necessary to use time exposure in order to bring out the low lights. This called forth from H. E. Ives the statement that a special plate, suitable for this purpose, had been supplied to astronomers for use during solar eclipses. It was a triple-coated plate.

Mr. Flexner stated that in Chicago

the commercial section was educating its solicitors to the requirements of good lighting and is handling every case, no matter how small the store, individually.

A. J. Marshall thought that every installation should be fitted artistically to the type of store in question. It was not well to consider them merely on the basis of so many watts per square foot.

E. L. Elliott stated that an engineer could be trained but that an artist must be born. Still he thought it would be well to have more papers before the Society on the fundamental principles of decorative art.

G. H. Stickney thought that the first study should be of present practice and the state of the art. He said that the recommendations given in this paper had been gone over and approved by many engineers.

C. O. Bond referred to the fact that the recommended values for the watts per square foot were low in the stores selling food and high in those selling clothing, from which he inferred that the average American paid more attention to dress than to hygiene.

H. T. Owens thought the recommendations would not be of much use in future practice, which would tend more away from direct lighting.

C. L. Law then closed the discussion, pointing out that the paper covered the small and poorest stores where artistic features were not prominent.

The next paper was by Thomas W. Rolph, and was entitled "The Engineering Principles of Indirect and Semi-Indirect Lighting."

Indirect and Semi-Indirect Lighting.

The first part of Mr. Rolph's paper is an abstract of a similar paper he presented before the Pittsburgh Section of the Society last May. (See ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, June 15, page 1140.) The general conclusion then presented was that the direct component of a semi-indirect system should be between 10 and 15 per cent of the total illumination. To verify this finding further observations were made with a duplex unit whose direct and indirect illumination components could be changed through a wide range without altering the total illumination. The first tests were on the observance of specular reflection when reading magazines; the results indicated that this becomes perceptible when the direct component exceeds 10 per cent of the total illumination. Other tests on the annoyance from shadows indicated that the direct component should not exceed 20 per cent. Investigations were then made as to the best distribution of light from indirect and semi-indirect equipments. These involved a study of the character of ceiling reflection, the effects of light distribution on efficiency and the determination of a theoretical or prototype photometric curve. The final conclusions of the paper are that the engineering advantages of semi-indirect lighting are obtained to the fullest degree and most efficiently, if the prototype curve is based on the following considerations: the flux below 60 degrees from the nadir is six per cent of the total flux; the candlepower values between 60 and 105 degrees are low; above 105 degrees the candlepower increases to a maximum at 145 degrees and provides for approximately uniform ceiling illumination between 145 and 180 degrees.

The discussion was opened by L. B. Marks, who questioned whether the walls should be dark. Indirect lighting systems give the worst condition of glare from specular reflection, as in one drafting room which he had observed. In that case unidirectional lateral lighting was much better. He considered, therefore, that the statements of the author were not generally true and suggested a number of conditions which would affect the author's results.

J. R. Cravath also questioned the use of dark walls and as to whether a small direct component of the light was any aid to the perception of perspective. He did not think the efficiency was improved any by using 10 or 15 per cent of direct light. Semi-direct lighting is not usually as efficient as the best indirect installations because suitable glassware is not available. He agreed that indirect lighting does not eliminate specular reflection.

P. S. Millar thought that such tests should be carried out in a large room with more than one lighting unit. At a previous meeting S. G. Hibben had presented a paper in which he found 50 per cent component of direct lighting desirable.

Hans K. Ritter then described a combination of lamp, reflector and diffuser which had come into large use in Europe and was being introduced in this country. A description of this unit will be found elsewhere in this issue.

The discussion was continued at the session on Thursday morning by W. F. Little, S. G. Hibben, M. Luckiesh, E. J. Edwards, D. McFarlan Moore, T. Spaulding, C. W. Jordan and H. E. Ives. Mr. Luckiesh thought the result of 15 per cent for the component of direct lighting applied only to special conditions. The value really depends upon intrinsic brilliancy of the source and cannot be expressed in terms of the total flux. Mr. Spaulding gave the results of some tests on the relative efficiency of direct, indirect and semidirect lighting in a room 20 by 40 feet. Eight units were used, using a total of 1.5 watts per square foot. The relative values found were 3.3 for direct, 2.5 for semidirect and 1.74 for indirect. Criticism was made by several of the speakers upon the use of the term "specular reflection."

Wednesday Evening Session.

At the session on Wednesday evening Bassett Jones, Jr., gave an illustrated talk on "The Color Values of Illuminated Surfaces," in which he demonstrated the relation of illumination to architecture and decoration. Plaster casts in both white and color were subjected to artificial illumination from various directions and of various colors and the effects of this in distorting or in properly presenting the decorative features was fully demonstrated. Examples were also shown of the effect of colored light upon various fabrics and painted surfaces.

This was followed by a discussion, participated in by many members of the Society, of matters affecting the welfare of the Society, with special reference to the questions of revenues and expense. It was shown that the receipts for the current year will be less than the expenses incurred and that it was necessary to increase the income or decrease the budget of the Society. Reports were presented from the Committee on Revenue by William J. Serrill and from the Committees on Finance and Financial Policy by L. B. Marks. Propositions for increasing the revenue consisted in increasing the dues, constituting two classes of membership, one of which should pay higher dues, providing for company membership, life membership, and an increase in the advertising in the *Transactions* published by the society. The Committee on Advertising reported a large increase in the advertising secured, part of which comes into effect immediately and part at the beginning of the next calendar year. Various propositions were made for the reduction of expenses, the only ones receiving much endorsement being for the curtailment of section expenses and the discontinuance of stenographic reports.

Thursday Session.

A paper by W. D. Ryan entitled "The Lighting of the Buffalo General Electric Building" was presented by H. E. Mahan.

Mr. Ryan's paper, which is copiously illustrated, gives a summary of the exterior and interior lighting of this monumental office building. The main portion of the building is only four stories high, but on the corner is an octagonal tower of 14 stories and a total height of 300 feet. The exterior is of glazed white terra cotta. In the plan it was attempted to introduce the latest developments in the art. Outside 6.6-ampere series ornamental magnetite arc lamps are mounted on standards on the sidewalk line. Similar lamps are used on the cappings of the tower steps at the fourteenth and fifteenth stories. The effect at night is that of a white building relieved by the warm yellow light of the tungsten lamps streaming through the windows. The colonnade at the top of the tower is illuminated by concealed blue-purple light, which contrasts strikingly with the white light thrown on the outer surface of the columns by the magnetite arc lamps. The tower is surmounted by revolving searchlight beams at a level of 300 feet above the street. These are produced by three 30-inch projectors that are ro-

tated individually by means of motors, and the whole group mounted on a revolving platform in the dome. They produce color evolutions by means of screens mounted on the projectors. Throughout the interior semi-indirect lighting is used with tungsten lamps and specially designed fixtures. The average watts per square foot is 1.4. The connected lighting load is 108 kilowatts. The foot-candles vary from four to six. The main units in the offices are of the convertible type, making it possible for the respective tenants to have either semi-indirect lighting, or, by inverting the reflectors, direct lighting.

Allen T. Baldwin then presented a paper by Richard B. Chillas, Jr., and himself, entitled "Characteristics and Tests of Carbons For Inclosed Flame-Arc Lamps."

Flame-Arc Carbons.

In the first part of this paper Messrs. Baldwin and Chillas discuss the characteristics of flame carbons for inclosed lamps. Of these the most important is reliability in operation. This is affected chiefly by the accumulation of slag, which is fused flame material that may collect in any position about the electrode points. It interferes frequently with the establishment of the arc or the maintenance of the circuit and gives rise to what is known as slag outage. Steadiness in operation is affected chiefly by changes in the amount and composition of the vapors in the arc. The candlepower of the lamp increases both with the arc cross section or current and with its length or voltage. Series lamps burn more steadily than multiple lamps. Unsteadiness may manifest itself as rupturing, flickering or gradual fading of the light. The life of a trim of carbons is affected chiefly by the tightness of the inclosure and also by the wattage of the arc. The comparative determination of the colors of different arcs is a very difficult matter. It must be done with other conditions as nearly identical as possible. The yellow-flame carbons are the least expensive and most efficient. The white-flame carbons are more expensive and less efficient. In determining efficiency, candlepower measurements should be made of the total flux of light by the means of an integrating sphere. The paper then discusses somewhat in detail the test of carbons for these five different characteristics. It outlines the records that should be made in each test and gives precautions that must be observed.

R. B. Hussey thought that a wrong impression was given by the statement that there was no satisfactory flaming-arc lamp upon the market. He stated that there are 5,000 lamps, representing three different types, now in successful operation upon city streets. The outage does not exceed 0.5 per cent.

S. L. E. Rose stated that the slag was increased by switching the lamp on and off when it was first lighted.

T. Spaulding referred to some tests which he had carried out upon the steadiness of lamps in multiple circuits. Readings were taken every ten seconds of the candlepower, which, in a direct-current lamp, was found to vary from 500 to 3,600 candles, with an average of 1,400. With an alternating-current lamp of a later type the variation was from 600 to 2,200. Messrs. Stevens and Marks also joined in the discussion, which Mr. Baldwin closed by answering some questions which had been asked.

The next paper was by Frank A. Benford, Jr., on "Theory and Calculation of Illumination Curves." This paper developed equations for use in calculating illumination and showed how a tabulation of computed values could be made of assistance in such problems. A number of curves were given illustrating the method of application and the results. A chart has been constructed for use in applying the method and it is found that its use is as easy as a tabular or point-by-point method and the eye-strain involved in the graphical application is little more than in slide-rule calculations. The results are liable to small errors but are freer from large errors. A saving of time results.

This paper was discussed by G. H. Stickney.

A paper by C. E. Ferree entitled "Tests for the Efficiency of the Eye Under Different Systems of Illumination and a Preliminary Study of the Causes of Discomfort" was, owing to the absence of the author, not read in full but was placed before the session for discussion. The paper was a report of an investigation which has been taken up during the past year under the auspices of the American Medical Association. The object of this study was to devise and perfect a set of tests which will show whether or not the eye has fallen off in efficiency as the result of a period of work under a given lighting system, and that will enable one to make a comparative test of the tendency of different lighting conditions to cause discomfort of the eye. It was shown that the conventional tests can be made adequate for the determination of the efficiency of the unfatigued eye, but failed to show the loss of efficiency when fatigued. A new test is proposed for this purpose and consists in keeping a subject continuously under test and determining during what proportion of the time the test object can be discerned.

H. E. Ives opened the discussion by calling attention to the epoch-making character of the paper and referred to the matter of the introduction of the time element into the test. He pointed out that the author had found that daylight does not decrease eye efficiency so much as artificial direct lighting. Others who joined in the discussion were C. O. Bond, J. R. Cravath, W. J. Serrill and E. L. Elliott.

C. O. Bond then presented the report of the Committee on the Presidential Address, which also included Glenn Webster and H. B. Dates. The committee indorsed the statements in the address regarding the mission of the Society and the work which it had to do.

George S. Barrows then presented a report of the Committee on Resolutions, consisting of S. E. Doane, C. H. Sharp and himself. Resolutions were presented expressing the thanks of the Society to the members of the various committees, the Hotel Clifton and the companies and individuals who had contributed in making the convention such a great success. The convention then adjourned.

Entertainment Features.

On Monday evening a dance was given in the ball room of the Hotel Clifton.

On Tuesday evening a banquet was held, which was attended by 106 members and guests. Arthur Williams acted as toastmaster and in a happy vein called upon various members and guests of the Society to respond to toasts, including two of the ladies, Mrs. P. S. Millar and Mrs. Norman Macbeth. Alumni of various colleges were grouped at separate tables, whence proceeded yells of all descriptions throughout the evening. Those not graduates of the colleges proved themselves equally adept in livening up the proceedings by means of songs and yells. Everyone pronounced this dinner the most jolly which the Society has yet held.

On Wednesday afternoon a trip was taken by trolley car through the Niagara Gorge, with stops at the Brock Monument, Lewiston and the Whirlpool Rapids. Norman Macbeth, chairman of the Committee on Arrangements, astounded the party by his knowledge of the history and geography of the vicinity.

Automobile rides and card parties for the visiting ladies were provided during the sessions of the Society.

Municipal Electric Motors for Hire.

The *Yorkshire Observer*, of Yorkshire, England, states that the electricity subcommittee for the Leeds Corporation has requested sanction to borrow $48,665 for the purchase of electric motors to be let on hire under the jurisdiction of the municipal electric-plant authorities. It is proposed that the motors shall range from one-half to ten horsepower for single-phase and from two to fifty horsepower for two-phase motors, except by special arrangement with the manager, who is authorized to act according to his discretion. Any hirer will be permitted to purchase the motor hired by him at a price not lower than the net figure at which it stands in the books of the corporation. Each motor and each separate or detachable part of the hired apparatus will have a plate affixed showing its ownership.

Association of Edison Illuminating Companies.

Annual Convention, Hot Springs, Va., September 10-12.

In the president's opening address at the 28th annual meeting and 33d convention of the Association of Edison Illuminating Companies, President George H. Harries gave a resume of the progress of the industry during the past year, pointing out particularly the considerable change in the lamp situation due to the rulings of the federal courts in their consideration of this question, and also pointing out the apparent considerable improvement in the performance of tungsten lamps as well as the reductions in prices. Among the other points brought out was the large amount of welfare work being done by the member companies in the interests of their employees.

The report of the Meter Committee was presented by the chairman, S. G. Rhodes, New York.

Meter Committee Report.

It would appear to the committee that manufacturers should be requested to continue their investigations to the end that a low-capacity, cheaper, house-type meter may be available. The committee feels that, with the large number of very small installations each of which yields a small income and requires a meter capacity approximating but one-half kilowatt, there is a field for a specially designed house-type alternating-current meter.

The committee has recognized the large part that the meter investment bears in the customers' costs and more particularly the preponderant part the meter investment represents for certain classes of consumers, large in number, and realizes the obvious necessity of a meter at a cost less than any now available. In addition, therefore, to the recommendation advanced for a special low-priced alternating-current meter for apartment houses and similar installations, it would especially urge at this time the consideration of a meter for direct-current supply along the same lines and for the same class of consumer.

The ampere-hour meter would appear to be the only type of meter available for these low-capacity, and, it must be admitted, for the greater part unprofitable installations, and, further, such meters must apparently be brought from abroad. The possibility of any other conclusion is remote when it is considered that the efforts of the several committees over a number of years have produced nothing for this special service from the American manufacturers. American meter practice, as far as the manufacturers go, is seemingly committed to the watt-hour meters and developments continue only along the routine lines of watt-hour practice.

The ampere-hour meter is used extensively abroad in many types by electricity supply companies using as well watt-hour meters and the favor in which it is held can best be appreciated when it is noted that 85 per cent of the meters installed in England alone are of some one of the ampere-hour types. The ampere-hour meter has received the unqualified approval of such representative governmental authorities as the Board of Trade, England, the Reichsanstalt in Germany, and over the Continent generally, and it would appear that such approval and such continued use of the type should make for their favorable consideration in this country for the specific purpose in mind.

The report pointed out the importance of securing a cheap direct-current meter for small residence business. It was thought desirable that the committee for the next year look into the utility of the ampere-hour meter as used abroad.

Samuel Insull in discussing this important paper pointed out that with the use of tungsten lamps and the reductions in electricity rates for the large class of residence consumers, the cost of meters became a very serious handicap, this cost being very high as compared with the cost of other equipment. The report was further discussed by Messrs. Rice, Vaughn, Cox and Lieb.

The paper, entitled "Development of Meter-Testing Methods," was read by Frank V. Magalhaes, New York.

Meter-Testing Methods.

The paper is intended as a description of various devices and methods which have been developed to promote accuracy and economy in meter testing. The various devices and methods are not advanced as being necessarily new or unique, nor as necessarily adaptable to all conditions or organizations. The intention has been to describe and illustrate the development of certain details of laboratory and service meter testing which have been carefully worked out and in actual practice produce the desired results.

The availability of proper instruments, accurately maintained, is a prime requisite for accurate meter testing. A detailed description of the instruments provided and maintained for meter testing is given, but it can be stated briefly that high-grade portable instruments are available providing suitable ranges of current and potential for all capacities of watt-hour meters in service.

In the discussion the more extensive use of the "errometer" method of testing was brought out, this method having been perfected in the meter department of the Philadelphia Electric Company. J. F. Gilchrist participated in the discussion.

The report of the committee on "Electric Heating and Kindred Uses of Electricity," was read by M. E. Turner, chairman, Cleveland.

Electric Heating.

The report last year referred to the development of an electric range operating with a 100-per-cent load-factor and based on the storage of heat from a small, continuous and unvarying input of current. In making this of commercial value, the chief problem has been one of thermal insulation in order to effect the desired conservation —a problem not only of design, but of materials. Carbonaceous or vegetable lagging material has not been considered good enough for the high temperatures of range operation; the development has been largely occupied with researches for more stable substances. These efforts have been successful.

Furthermore, a fairly non-conducting metal has been found and its use greatly conserves the heat where metallic connections are necessary from the interior to the outside. The use of metals is quite important from a manufacturing standpoint and permits a more commercial and practical construction.

This has led to the development of individual storage stoves, which can be built with a neat, simple self-contained cylindrical construction. Simply lifting the cover exposes the red-hot stove block for use. The stoves will operate on from 150 to 225 watts continuously.

Two or three of these individual stoves, plus a separate storage oven, is the equivalent of a range, and such a system has an advantage of flexibility as to installation. The oven will require 200 to 250 watts. In addition to this, water heating has been provided for by placing a 500-watt storage element in a kitchen tank, so that a complete system may be had consuming 1,000 watts or more.

Broiling seems to be best accomplished by using 1,000 watts, intermittently applied when needed, diverted from the storage units by a throw-over switch.

The report brought out in detail the different methods used in the larger cities of selling electrical devices. Samuel Insull in discussing this report stated this was one of the most valuable matters for consideration at this time, pointng out that with the increased use of these devices central-station companies could offset in a measure the reduction in their residence incomes where tungsten lamps were extensively introduced and in cases where rate readjustments were about to be made. The paper was further discussed by Arthur Williams, T. I. Jones and E. W. Lloyd.

The paper by C. E. Stephens, Pittsburgh, entitled "Good Practice in the Application of Modern Light Sources as Exemplified by Recent Installations in Industrial and Street Lighting," was next read.

Modern Light Sources.

The aim of this paper is to discuss briefly the necessity and requirements for artificial illumination, the light

sources available, and the application of modern lighting units to industrial plants and streets.

No doubt the greatest activity has been in the lighting of industrial plants and of streets.

Considering average weather conditions on our continent throughout the several seasons of the year, we note that out of every twenty-four hour day we have an average of 11¼ hours of darkness, four and one-half hours of cloudy or foggy atmosphere and only seven and three-quarters hours of sunshine. Within recent years we have arrived at a point where the demand for the product of our industrial plants is so great that it has become necessary to operate the plant continuously, day and night. Then, too, modern processes of manufacture need to be carried on continuously, and the tremendous investments in plant equipment require that the plants be operated full time to secure greatest economy. Artificial light is therefore an absolute necessity.

Assume that the annual maintenance cost of good light for a typical factory section is $150. Assume also that there are twenty workmen in this section whose annual wages total $14,000. Add to this an assumed overhead or indirect factory expense of 90 per cent, and the gross operating cost of the section will be $26,600. The maintenance cost of the lighting system is therefore approximately 0.56 of one per cent of the gross wages. This per cent of the total wages for a 10-hour day is equivalent in time to approximately five minutes. Assuming further that the cost of supplying poor illumination will cost one-half this amount, it can be seen that if adequate light will enable a workman to do more or better work to the extent equal to approximately three minutes in wages per day, the additional cost of adequate over inadequate illumination will have paid for itself.

While the various items which contribute to the value of good illumination are such as to prevent accurate tabulation in dollars and cents, sufficient data are available to show that the annual output alone of the various industrial plants in the United States could be increased from one to eight per cent by an adequate lighting system. In the 1911 report of the Department of Commerce and Labor we note that in 1909 the United States had over 260,000 manufacturing establishments, employing during the year an average of seven and one-half million persons, of which six and one-half million were actual producers. These factories paid over four billion dollars in salaries and wages and turned out products to the value of nearly twenty-one billion dollars, to produce which materials costing over twelve billion dollars were consumed. The value of the manufactured product which was added by manufacturing operations was over eight billion dollars. Assuming that the average increase in output for all industries, attributable to improved illumination methods, would be one and one-half per cent, the anual saving for all industries would reach the enormous figure of three hundred fifteen million dollars, or over one million dollars per working day.

This paper pointed out the tremendous amount of money that could be saved throughout the country by the proper application of illumination throughout the different industries by improving the efficiency of the men working under artificial lighting conditions.

The report of the Committee on the National Electrical Code, A. A. Pope, New York, chairman, showed that the year which has elapsed has witnessed the adoption of the new requirements with respect to rubber-covered wire, which went into effect on July 1, 1912; also a change in the attitude of the Underwriters with regard to the grounding of secondary circuits, which, under certain conditions, has been permissible, but which it is now proposed to make mandatory.

An address on "Rates" was delivered by Arthur Williams, New York.

Rates.

The rates of an electric light and power company constitute the medium by which an income is, or is hoped to be, secured sufficient to meet its current obligations, provide adequately for necessary reserve and surplus funds and pay a reasonable return to those who have sufficient faith in the undertaking to invest in its securities. While available examples of rates run into infinite detail, they are constructed upon few and simple general principles. The possible fields in rate making seem to have been exhausted and the very hazardous prediction is made that in all probability the future holds nothing essentially new on the subject.

In this paper was given a resumé of the rates from those established in the first New York Edison Company down to the present time. It was pointed out that the conditions in various communities being different, it did not seem possible at this time to have a uniform basis of rate systems, some companies having worked very well and successfully under the "block system," others under "straight-line" meter rates and still other under the different demand systems of charging.

A very interesting discussion on this subject of rates took place after the presentation of this paper and a very interesting talk on the demand system and its many good points was made by Samuel Insull. Others discussing this report at length were Alexander Dow, John W. Lieb, Jr., E. H. Davis and E. W. Lloyd.

The report of the Committee on Incandescent Lamps was presented by John W. Lieb, Jr., New York, chairman. This was probably the best report on this subject ever made before this association. Mr. Lieb went into all of the important phases of the incandescent-lamp situation, giving very comprehensive data on the life, performances, efficiencies and costs of all sizes of Mazda lamps. Curves were shown indicating the rapid increase in the use of Mazda lamps and the rapid decline in the use of old standard carbon lamps. The report was discussed at great length by the representatives and manufacturers, including Samuel Insull, E. W. Rice, A. W. Burchard, A. D. Page and G. F. Morrison.

"The Present and Future of the Incandescent Lamp," a discussion of the report of the committee, was presented by John W. Howell, of Harrison, N. J.

Mr. Howell in a very interesting address pointed out the different methods used in the manufacturing of Mazda lamps and what it was necessary to overcome in order to bring the lamp to its present high efficiency and life, describing in a general way the important phases in the manufacturing process and demonstrating before the convention the smallest electric lamp ever made, as well as the largest, 0.125 and 2,500 candlepower respectively. He also called attention to the new process of eliminating blackening of the glass.

The paper entitled "Instrumental Methods of Measuring Maximum Demand," by T. I. Jones and W. Eichert, Brooklyn, was then read.

Measuring Maximum Demand.

At this time, when the matter of rates is being so generally discussed throughout the country, it seems pertinent to consider one phase of the rate subject as applied to the demand method of selling current. It is the purpose, therefore, in this paper to present for consideration certain features in connection with the instrumental methods at present in vogue for measuring the demand, discussing the general types of instruments now on the market for such purpose, their general qualifications and limitations, together with a consideration of the time interval in use with these instruments and the effect of variations of this time interval on the question of the rate schedule.

Various data and curves are shown to illustrate the effect of different measurements of time of peak and their possible effects on the rate.

From a consideration of the above a time interval of 30 minutes seems most desirable and a general adoption of such an interval by central stations in measuring the demand of the average power consumer seems advisable. It may be deemed advisable to make exceptions to this standard interval in selling current to railways or classes of business where the demand is materially different from that of the general light and power business of a central-station company, but if we are agreed upon the adoption of the demand basis of charging it seems that we should be also agreed upon the adoption of a standard demand interval and the general method of measuring such a demand.

In this paper was given a description of the various types of maximum-demand indicators now available for practical service, and also the effect of different time intervals in the measuring of the demand of different classes of business.

A very interesting discussion was entered into on this subject by Arthur Williams, Alexander Dow, D. L.

Huntington, O. J. Bushnell, J. C. Parker and E. W. Lloyd.

"The Welfare Plans of the Boston Edison Company," formed the subject of an interesting paper by Herbert W. Moses, Boston. Extracts from this paper follow.

Welfare Work.

The term "welfare work" seems to have been adopted almost universally, and I shall, therefore, adhere to traditions although I admit freely that I do not like the term, as it savors too strongly of charity and philanthropy. The term seems narrow and does not express adequately the purely voluntary desire on the part of employers in general to show their interest in their employees and their desire to do something more for the loyal, efficient and faithful employee than is expressed by the actual money that is received in the pay envelope. To make the employee feel that he is an integral part of the organization for which he works, that his services are highly desirable, and that his efforts are appreciated at all times, that his employer takes an interest in him whether on duty or incapacitated by personal illness or by injury, are, in a great measure, the results desired to obtain. The term "welfare work" does not embody such a broad meaning and I have puzzled much in search of a better phrase, and am obliged to pass on with an appeal for a suggestion which will embody and characterize the scope and true meaning of our endeavors in this direction.

It is oftentimes true that the more humble a man's position in society is, the greater his pride and more unapproachable he is regarding his private affairs and the more sacred he regards his home life. Even in my limited experience in this work there has been noted considerable difficulty in collecting the records of a more personal nature from among our employees. I mention this fact merely to show the reticence, bordering almost on suspicion, with which the workingman regards inquiries made into his private life, which inquiries are made only with the kindest intent. To acquire the fullest measure of success in the carrying on of welfare work, unusual tact is required, in securing first of all, the friendship, good-will and confidence of the employee himself. It is our wish to teach him that life is really worth living, and that it is our pleasure to contribute to his home comfort and that in return for his faithful services, both he and his family will be taken care of in time of need.

The discussion on this paper covered a description of a number of the plans in use by member companies and the great benefits derived from the use of welfare plans not only by employees, but by the companies as well.

The paper entitled "Promising Fields for the Development of Central-Station Business," by Charles J. Russell, Philadelphia, was then read.

Fields for Development of Central-Station Business.

A survey, in the abstract, of the present status of development in the central-station business would seem to show that this development, tremendous as it has been, has not yet reached a point where the economic advantages of central-station service are appreciated or utilized as they should be. The leaders of our industry have explored new fields and measured their possibilities as is evidenced in the minutes of this association and this work has been of tremendous benefit to the industry as a whole. The rational development of the various fields in which we can operate is of vital importance to the future of our business. It would seem that complete exploration of these fields, educational work among business men and our associated trades, as well as the co-ordination of engineering and commercial efforts are necessary steps in such future development.

The present paper is intended to stimulate attention and discussion upon the subject of the possible development of certain fields which, viewed in the abstract, seem full of promise in commercial results.

The present status of the central station in any given community represents the progress made toward our ideal—the common supply of electric current for all possible purposes. This ideal expresses one extreme condition. At the other extreme stand the use of other agencies for such purposes and the individual supply of electric current through plants operated by those using it as an agent for translation into light, heat, power or chemical energy.

Recent developments have led to a marked change in the attitude of central-station companies upon the subject of the selling price of current partly as the result of systematic study of costs and the factors affecting them and partly, without doubt, as the effect of the remarkable results obtained by those companies supplying large power and railway loads at low rates. In such cases the modifying limitations of cost have been removed and the status of such central-station companies has swung up to a higher degree of the ideal development.

Every economic consideration favors the centralized supply of electric current for all possible purposes in a given district and the size of district that may be served is only limited by the feasibility of transmission and the expense of distribution. The difference between the amount of the investment necessary for individual plants and that amount necessary for a common supply of electric current may be invested in other productive enterprises to the profit of their owners and with resultant increased prosperity in the district served. Capital invested in centralized supply has its productive value increased through the greater capacity purchased per unit dollar. The productive value of capital so invested is increased materially through the diversity-factor resulting from the service of diversified current demands. The balance of capital free for investment as the result of these two conditions may be made productive through use in other channels.

The paper entitled "One Phase of Merchandising," by Leavitt L. Edgar, Boston, was read.

During the past few years central-station companies throughout the country have been giving more and more time to the promotion of current-consuming devices and have been appreciating more and more the tremendous possibilities in this class of business.

Unfortunately, the manufacturers have attempted to put the burden upon the central-station people for the introduction of their product, arguing that their interest ceased when the device was sold, but that the company's income continued as long as the device was in use. The companies have, therefore, in self-defense, had to do more than their share in promoting this class of business.

It was pointed out in this paper that in canvassing the country for information on electrical devices that could be exhibited at the Boston Electric Show, that while there were a tremendous number of such devices on the market, in many instances it was found that the manufacturers had very little market outside of their immediate locality.

The report of the Committee on Storage Batteries was presented by W. S. Yeager, chairman. The consensus of opinion was that this report was the most complete and comprehensive compendium of information on storage batteries available and that this report should be in the hands of everyone using storage batteries for central stations, for vehicles, or other kinds of work.

The report of the Committee on Electric Vehicles was presented by E. W. Lloyd, Chicago, chairman.

Electric Vehicles.

The committee emphasized the fact that merchants in a community cannot be expected to be enthusiastic about the use of electric vehicles if the local company is backward in their use.

Recent cases have been reported where electrics have come to the fore in cities where the streets are extremely hilly. Conditions in such cities are not favorable to electrics, but neither are they to any other kind of vehicle. The mileage per charge of battery is considerably less than can be obtained from the same vehicle in level streets, but so is the daily mileage which can be obtained from the horse. The gasoline truck is also greatly handicapped on grades, and while its available mileage is not reduced, the difficulties of manipulation are greatly increased.

Electric vehicles which are properly designed for work on grades give good account of themselves, and there is no doubt in the minds of those who have watched their performance but that the use of the electric truck will reduce transportation costs below what it is possible to reach with the horse-drawn vehicle under the same conditions.

Another exploded theory is that electrics are not adapted for service in heavy snows and in extremely cold weather. So conclusively has it been demonstrated that electrics are seldom unable to make their way through the streets when the road conditions are unusually bad that it is unnecessary to submit data to prove the fact.

The committee wishes to say that while it believes it very important that member companies assist in the compiling of information relative to the cost of operating freight vehicles under different conditions, that it does not believe it necessary to present these statistics for the purpose of proving the practicability of the electric commercial truck. It does, however, wish to

impart in some degree the feeling of confidence it has in the future of the electric-vehicle business and to leave the thought with the skeptical ones that if they are not doing everything they can to introduce the extensive use of electrics in their community, they are overlooking a most fruitful source of profitable business.

The paper was discussed by Arthur Williams, John F. Gilchrist, and John C. Parker, the discussion bringing out the very great opportunity afforded central-station companies in the exploitation of the electric vehicle, the necessity of co-operation and more than anything else the use of these vehicles in the service of the central stations themselves.

It was pointed out that the vehicles had passed the experimental stage and were of great service in many lines of work, and the cost of operation had reached the point where there need be no competition from horse-drawn vehicles and in certain classes of service the electric vehicle was without a rival. It was brought out that the manufacturers were overcrowded with orders at the present time, the indications being that the use of these vehicles has increased very rapidly, and that in some cities the total number of vehicles in service had doubled during the past twelve months.

The paper entitled "Improvements in the Design of Reactance Coils of Large Capacity," by Philip Torchio, New York, was read.

Reactance Coils of Large Capacity.

With the continuous increase in size of central stations, the problem of protecting the system against enormous concentration of power in accidental short-circuits becomes of paramount importance. It was early pointed out by our fellow member, Dr. Steinmetz, that the introduction of liberal reactances in the circuit of the generators and buses would tend to solve this problem. Since then the High-Potential Disturbance Committee has made favorable recommendations on the use of external reactances and several companies have equipped their stations with reactances for this purpose.

It was in the attempt to obtain a type of apparatus that would give the best results as to economy and safety, and also meet with the requirements of the usual operating conditions in stations that the reactance coils described in this paper were developed.

The difficulties inherent in the design of reactance coils for high-voltage generators and tie buses increase greatly with their increase of capacity.

An ideal coil should be self-inclosed, self-cooled, mechanically strong and fireproof, besides having good electrical and insulating properties.

The final construction adopted for these coils is illustrated in several photographs. The coil consists of horizontally wound spirals supported and insulated by porcelain arms with suitable recesses for the windings; the arms are assembled radially as vertical walls between a center core of alberene stone and an outer inclosing wall built up of special porcelain segments. These cellular compartments so formed allow natural ventilation for the coil. The whole is supported at the two ends by heavy concrete headers, securely fastened to the wall by a series of brass bolts passing through the heads and the special porcelain segments from top to bottom. Ventilating holes are placed in correspondence with each vertical cellular compartment of the coil.

A paper on "Fuel Oil," by F. H. Varney, of San Francisco, was next read.

Fuel Oil.

The burning of fuel oil has many advantages over coal. First, however, the possibility of future supply is important. This we are assured is sufficient to meet the demand (with the present development) for about 75 years, and it is assumed that by the development of prospective territory, there will be sufficient to last (at our present rate of consumption) for a period of 230 years.

This is based on the development of approximately 450,000 acres and an estimated production of 15,000,000,000 barrels (42 gallons per barrel) of oil, which is said by the State Mining Bureau to be a conservative figure.

In comparing the evaporative values of coal and oil, a coal that is considered standard and one that is largely used for evaporative tests has been selected.

Without any particular knowledge on the part of the writer by actual experience, Pocahontas coal appears to be enough generally known to be used as a standard. This coal has a calorific value of approximately 14,800 B. T. U. per pound. From test data at hand, an average equivalent evaporation of 11 pounds of water per pound of coal, equivalent to 72 per cent efficiency, can be considered as very good boiler-room practice.

With an average oil of 14 or 15 degrees Baume, 18,700 B. T. U. per pound can be considered as the calorific value, and an equivalent evaporation of 16 pounds of water per pound of oil is readily accomplished, which is equivalent to over 82 per cent efficiency.

The heavier gravity oils show better economy in operation, although having less heat units per pound of oil, because of the fact that 42 gallons of heavy oil contain more heat units than 42 gallons of light oil, and oil is purchased by the 42-gallon barrel.

The paper was discussed by W. L. Abbott and D. L. Huntington.

Mr. Abbott pointed out that fuel oil had been used in Chicago something like seventeen years ago, but that with Illinois coal at present prices, oil could not compete with coal in Chicago. It was pointed out that in California the price of coal was as high as $8 per ton and conditions being vastly different, oil was the only possible fuel in conjunction with power, mainly secured from hydroelectric developments.

A paper entitled "Operating Pilot Board and Station Interconnecting Systems," was read by W. A. Lawrence, New York.

When the first Waterside station of the New York Edison system started in operation in 1901 generating high-tension alternating current transmitted for transformation and distribution to numerous substations, in view of the close relation between the generating, transmission and transforming systems, to insure reliability of service and to guard the safety of employees working on high-tension apparatus, the direction of the system operation was centralized under one head, the system operator.

That the conditions of the system at all times might be displayed graphically before the system operator, a pilot board was constructed, on which all oil switches in the generating stations, oil switches on transmission cables in substations, and transmission cables were indicated.

The efficiency of such a pilot board was limited by the number of tags involved and the ability of the system operator to keep the board tagged correctly. As the system increased in size from year to year the limitations of this board became more and more apparent, and to meet this condition an automatic pilot board was designed and built which automatically indicates the operation of all oil switches in the generating stations and does away with all tags except a few which are used to indicate apparatus on which work is being done.

Current to operate the board is supplied from two three-kilowatt, 30-volt motor-generator sets, which may be operated either from the exciter system or the station lighting system.

The board at present is equipped to indicate three generating stations and eighty substations, space being left at the top for two future generating stations.

Voltmeters and frequency indicators connected to both the 25 and 60-cycle systems of each Waterside station and indicating wattmeters to indicate the interchange of current between the stations are installed on panels at either end of the pilot board.

Briefly described the system operates as follows:

When an oil-switch closes, circuits are closed, starting the interrupting wheel by which impulses are sent to the stepping magnet of the rotary switch, and to line relays which operate the stepping mechanism of the rotary switch at the pilot board, so that the two rotary switches operate in synchronism. The arm of the rotary switch continues to step around its contacts until it strikes a contact made "alive" by the closing of the oil switch, when a circuit is closed through relays which stops the rotary switch and the interrupting device, allowing the rotary switch to return to its starting position. The rotary switch at the pilot board acting in synchronism with the one at the generating station also stops and completes a circuit through a polarized relay which lights the red indicating lamp corresponding to the switch which has closed. When an oil switch opens, the system operates in the same manner, except that auxiliary line relays are energized by means of which the direction of the current through the polarized relay is reversed and the green lamp is lighted.

A paper entitled "Some Controlling Conditions in the Design and Operation of Rotary Converters," was read by B. G. Lamme, Pittsburgh.

Experience shows that the rotary converter is one of the most satisfactory and reliable of the various types

of rotating electrical machinery. In its efficiency of transformation, its commutation and temperature characteristics, and its operating characteristics in general, it makes an extremely good showing. Furthermore, it is a type of machine which has not changed greatly in the last decade, although there have been many minor changes not visible to the layman, which, however, have added materially to the operating qualities of the machine. The more recent developments have been principally in the use of commutating poles and in a very material increase in the rotative speeds, these two features, however, being closely allied.

In considering the various characteristics of the rotary converter, such as its current and voltage capacities, electromotive force, regulation, commutation and the use of commutating poles, maximum speeds permissible with a given output, etc., certain fundamental conditions or limitations in the design, are of controlling importance. These are discussed in the paper.

This paper was discussed by Charles P. Steinmetz and W. L. Emmet. The paper brought out the point that while until recently the rotary converter had not been satisfactorily operated on 60-cycle circuits in the conversion to direct current, that it was now perfectly feasible and more satisfactory to operate rotary converters on 60-cycle circuits than to use motor-generator sets.

A paper entitled, "Continuity of Service," was read by S. D. Sprong, New York.

Continuity of Service.

The title is a very inclusive one, but the paper is limited to certain phases of the question of maintaining continuity, particularly on alternating-current systems, and some of the means and more recent developments that are employed to attain this end.

It is interesting to note that throughout the history of the development of the alternating system, it has had to meet all the problems that confronted the direct-current engineers and in addition an almost bewildering number of special conditions peculiar to the system itself.

The continued growth of the industry brought about in the alternating-current districts numerous cases where the demands were within the range of economic distribution by direct current, However, with the investment already made in alternating-current equipment on the part of both the companies and their customers, the thought of changing from alternating to direct current was an economic problem of almost impossible proportions and has rarely been resorted to.

Notwithstanding the apparent defects from the point of view of continuity of service of the alternating-current system due to its much greater susceptibility to disturbing causes, it met the requirements of its particular field with reasonable satisfaction and it was not until it was called upon to handle a dense load that the problem of securing continuity of service comparable with the direct-current system and to a degree measured by the greater obligation to its customers individually and the public as a whole, had assumed serious proportions.

A very interesting address was given by George F. Holberton, San Francisco, on the development of the electric power and gas business in central California with San Francisco as a center. The pumping of water for all kinds of irrigation service as well as the pumping of water in the draining of land was discussed. Further, the use of power for all sorts of service, even so far as the furnishing of power to motor-driven gold dredges was discussed. Very interesting lantern slides were shown on power applications throughout the state of California.

A very interesting address given by Dr. Steinmetz pointed out the already tremendous development of the central-station idea and the future possibilities of such development with plants centrally located in districts sending out energy in all directions to a vast area for all such power service including lighting, general power, railway systems, traction lines, electrochemical developments, pumping, etc. The possibilities of such development being difficult to foresee, the sizes of coming generating plants and systems would be vastly greater in extent than anything thought of at the present time.

The report of the Committee on High-Potential Disturbances was presented by S. D. Sprong, chairman.

High-Potential Disturbances.

The practice of metering all current used for light, power and auxiliaries in the generating station, has developed certain weaknesses in low-ratio transformers used on the primary side of motor-driven exciters. Some companies interpose transformers between the supply and the motor as an expedient. In one case the motors were rewound for a lower voltage. The use of one-to-one transformer ratio seems to have the slight advantage of leaving means for operating motors by direct connection to the bus for limited periods covering repair or cleaning of the transformers. Favorable results have been secured with the new S. & C. chemical fuse. The inclosed type of fuse recently developed by the General Electric Company is also proving satisfactory. As a general result the introduction of reactances in series with high-tension oil switches is to so reduce the amount of current to be handled by the switch that the resultant is in favor of the use of the reactances. Mixed overhead and underground systems do not involve any unusual hazards that cannot be taken care of by standard protective devices. The tendency in aluminum-cell arrester practice is running more to the use of charging resistance, and in the case of large power stations to use of fuses in series with the arrester tanks. Improvement in the electrolyte has practically eliminated any trouble heretofore experienced with fungus growths. There has been no radically new development in overload relays and relays intended for selection between central stations connected in tandem. The introduction of a fifteen per cent reactance in one case and a four per cent reactance in another case has eliminated hunting between stations in parallel upon building up of the load.

The report of the Committee on Steam Turbines was presented by W. L. Wells, chairman.

Steam Turbines.

There has been activity among the American manufacturers who are now ready to furnish horizontal turbines of greater capacity than were available last year, with guarantees equal to those offered by foreign manufacturers. The advisability of periodic tests is evident, as operating economies may be affected by deteriorations of nozzle and blading, changing of clearance or accumulation of deposits on blading. There has been a marked improvement in the design of types of fittings and valves used in modern high-pressure steam stations. The development of the small steam turbine has made very rapid strides in the past few years. The multi-stage centrifugal pump is rapidly becoming the standard type of boiler-feed pump.

Turbines for Rio de Janeiro.

The Rio de Janeiro Tramway, Light, and Power Company at Pirahy, Brazil, is installing two more turbines, each of 20,000 horsepower, so that the plant will altogether have available nearly 100,000 horsepower. The turbines are provided with vertical shafts, which are suspended, the wheels being at the lower ends. The nozzles, of which there are four to each wheel, are controlled quite independently of one another by levers from a motor. Two discharge ports are provided in the wheel casings in case of accident. A sluice valve is also arranged on the supply main; this valve and the outlets are operated by the pressure regulator. These measures are very necessary, since the turbines work under a head of 940 feet and, running at 300 revolutions per minute, consume about 219 cubic feet of water per second. Each turbine is combined with a set of two three-cylinder high-pressure pumps for the oil feed, which supply 80 gallons of oil per minute. These are driven by small Pelton wheels. There is a pressure-bearing between the turbine and generator, in addition to the footstep, which has to support a load of 76 tons —the weight of the revolving parts.—*Engineering.*

Gas-Operated Power-Station At Kamata.

The Japanese Government determined some time since to electrify its railway between Tokio and Yokohama. After much consideration, it was decided to generate the energy necessary by means of gas power.

The station is designed to accommodate four gas engines, each rated at 2,000 brake horsepower, when running at 94 revolutions per minute. The producers are located in a separate building.

New Electrical and Mechanical Appliances

New Electrical Tabulating System Invented by the Treasurer's Department of the New York Edison Company.

Less than 20 years ago the adding machine, then a recent contrivance, was one of the wonders of the age. It had long been antedated by inventions of a crude type, such as the abacus and the logical machine, which attempted to reduce to mechanics the relation of thought and numbers and to simplify the operation of thinking and adding, but they were toys and curiosities, standing in about the same relation to an adding machine of the latest model that a bark canoe bears to a modern liner.

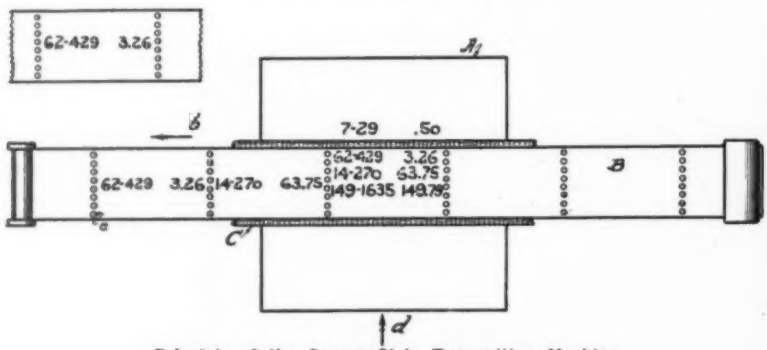
In the year 1894 the first really serviceable adding machine was built and marketed, and probably, even in that decade rife with discoveries, no one suspected what wide application would be found for the new invention. From being a luxury indulged in by comparatively few banking houses, it has become invaluable to industrial and commercial concerns throughout the world for reckoning and statistical purposes of every description.

Of the modifications and improvements made in the adding machine within the last three or five years, possibly the most radical and ingenious one is the coupon-strip typewriting machine, recently patented and attached to four 17-column Burroughs adding machines, used by the New York Edison Company for assorting and tabulating work in connection with keeping accounts and recording statistics.

The invention relates to a typeprinting or typewriting apparatus and consists in mechanism whereby, simultaneously with the production of lines of printing disposed in columns on an impression sheet, a facsimile imprint may be made of the lines in sequence upon another sheet, the second sheet being moved in front and transversely across the first sheet. The second sheet may subsequently be divided into coupons, if desired, each coupon then bearing one of the lines collectively printed in columns on the first sheet.

The application of the invention is illustrated in the accompanying photograph of a Burroughs adding machine equipped with a coupon-strip typewriting machine. The diagram illustrates the principle of the new device.

A is a sheet of paper which is moved in the direction of the arrow *d* so that a series of lines of printing indicated by the characters 7-29 — .50, 62-429 — 3.26, 14-270 — 63.75, 149-1635 — 149.79, suitably spaced one above the other in a column, may be typewritten thereon.



Principle of the Coupon-Strip Typewriting Machine.

B is a long strip of paper which will hereafter be termed the coupon-strip, disposed in front of the sheet *A* extending transversely across the same and longitudinally moved in the direction of the narrow *b*. Between the sheet *A* and the strip *B* any copying means, such as a carbon ribbon or sheet indicated at *C* is provided and an inking ribbon (not shown) is, as usual, disposed in front of the strip *B*, so that the imprint made by the type is produced simultaneously in facsimile on both strip *B* and the sheet *A*. The feed mechanism which actuates the coupon-strip *B* and sheet *A* to feed them respectively in the direction of the arrows *b* and *d* is to be so timed that during the interval occupied in moving sheet *A* in a vertical direction over the same, between two lines of printing, the strip *B* is caused to move in a horizontal direction over a much longer distance. The result is that there is imprinted on sheet *A* a series of lines of printing disposed vertically in columns one above the other; as:

7-29	.50
62-429	3.26
14-270	63.75
149-1635	149.79

and on strip *B* a series of lines of printing horizontally disposed in succession and separated by intervals between the end of one line and the beginning of the next line, as: 62-429 — 3.26: 14-270 — 63.75: 149-1635 — 149.79. After the printing is completed the coupon-strip *B* may be cut apart between the printed lines, or divided on the previously prepared perforated lines *c*, and thus converted into separate coupons, each bearing a single line of printing as indicated.

Machine in Operation.

The product of the machine, as a whole, is a sheet *A* bearing a column of printed lines and also a quantity of coupons *B*, equal in number to the

said printed lines and each bearing ne of the said lines in facsimile.

These coupons may be utilized in various ways; for example, the New York Edison Company uses them for assorting and compiling the very numerous cash payments received from customers daily preparatory to posting such credits on the ledgers. In comparing mail receipts, the checks and bills are placed in separate companion trays. The amount of the checks and bills contained in the trays at any time should therefore agree in the aggregate.

The listing of the checks and bills is performed at the same time. The checks are listed on a Burroughs fifteen-column machine, while the bills are listed on the new coupon-strip typewriting machine. The verification of this work is obtained by arbitrary divisions of 100 bills, the proof sheets used in this connection accommodating only that number of items.

In passing, it will be noted that the coupons are prepared simultaneously in listing the bills. These are detached and assembled according to ledger numbers and again assorted in sequence of account numbers. They are then listed on individual ledger sheets for posting purposes and finally they are listed on individual tickler sheets in divisions of 100 pages, thus furnishing desirable aid to bookkeepers in taking off trial balances.

In obtaining a proof of the several daily deposits, the source totals and the ledger totals are listed separately on a Burroughs adding machine equipped with the new coupon-strip typewriting machine. The coupons are assorted in numerical order and they are listed on two special sheets, one by sources and the other by ledgers, thus affording a verification with the deposit slips and a summary of the proof sheets referred to. By this means all the work of recording in connection with the treatment of cash payments by customers is reduced to mechanical labor, thus eliminating all mental additions and providing a most convenient record for rapid auditing and future reference.

From a practical standpoint the new machine is a complement of the adding machine, extending its scope by offering not one, but many, short cuts in various lines of accounting and statistical work, and it is claimed by the inventors that it will vastly increase the possibilities of the adding machine in all departments of industrial and commercial activities. The machine is readily adaptable to the specific requirements of distinctive classes of manufacturers, as well as to both small and large individual enterprises.

Several of the salient features of the machine may be enumerated as follows: (1) the coupons are valuable in accounting of every description for assorting and distributing work preparatory to tabulating; (2) they are useful for collecting, compiling and recording statistics; (3) valuable for checking purposes, as the coupons furnish both printed and totalized records; (4) and finally they are important as they contain the original records, and they may be filed card-index fashion for permanent record.

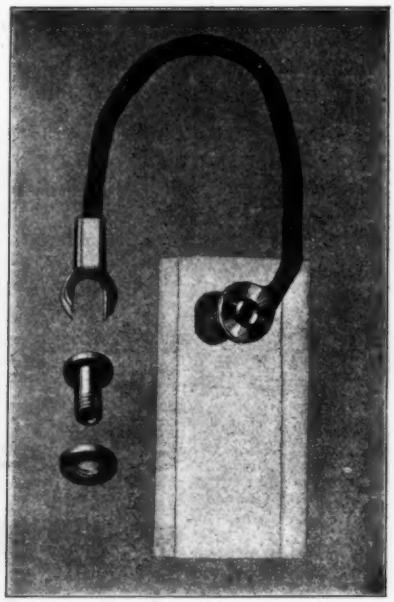
A Group of Machines in the Treasurer's Department, New York Edison Company.

More Telephones for the Central of Georgia Railway.

The Central of Georgia Railway has recently ordered from the Western Electric Company the necessary apparatus for making the third installation of telephone train-dispatching equipment within the year. The first section of road to be so equipped extended from Columbus, Ga., to Birmingham, Ala., and the second from Macon to Atlanta, Ga., For the third installation, practically the same type of equipment as that used on the other two will be furnished. The new section extends about 180 miles. This leaves only one section of the main line not equipped for telephone train dispatching—the division from Savannah to Macon—but plans are already being made for this installation. Seventeen way stations will be equipped and a similar number of siding telephones will be installed in booths to be built along the right of way. Every train operated on the division will carry a portable telephone set which may be connected to the line at any point in case of emergency, thus putting the conductor in touch immediately with headquarters.

Chapin Pig-Tail Carbon Brushes.

We illustrate this new invention for which patents are pending and which well shows progress in carbon brushes with shunts. The Charles E. Chapin Company, Incorporated, 201 Fulton Street, New York, N. Y., is the manufacturer of the Chapin brush and is well known in the quality of its products. For years carbon brushes with shunts had a soldered connection on the carbon and when the heat melted the solder, all sorts of trouble ensued.



Chapin Pig-Tail Brush.

In the Chapin pig-tail brush the necessity for solder is avoided by the secure manner in which the shunt is attached to the carbon. It will be noticed in the cut that the bolt has a conical hole in the end and when the nut is in position the threads of both the bolt and nut are jammed by a blow from a pin in the punch press.

The Mazda Stimulation Campaign.

During the fall of 1912 and the coming winter, a very extensive sales and publicity campaign will be inaugurated by the National Quality Lamp Division of the General Electric Company, Cleveland, O., to stimulate the sales of National Quality Mazda lamps. The campaign is laid out along seven distinct lines of attack, the following being a brief analysis of the various features of the general plan:

I. Magazine Advertising.

Beginning on September 14, a number of prominent advertisements in the *Saturday Evening Post*, telling Mr. and Mrs. American Citizen just what "National Quality" means to them. The follow-up system for inquiries will be carefully watched. If the inquirer's premises are not wired he will be sent a copy of the booklet, "Electric Service in the Home," while if his house is already wired he will be sent the "National Index to Correct Lamps for the Home."

II. Lamp Tags.

All carbon, Gem and refilled lamps shipped by National Quality works will carry a pasteboard tag advising the consumer that it will pay him to investigate carefully the merits of the Mazda before using any more carbon-filament lamps.

III. The National Mazda Stimulator.

This will be a monthly bulletin sent to all interested in the National Quality campaign.

Articles by leaders in the stimulation movement will appear at frequent intervals, but it is hoped that the contributions and experiences of salesmen will be the most valuable feature of this magazine in its relation to the campaign. Prizes of a varied nature will be offered for articles and suggestions.

IV.—Central-Station Advertising.

Each of the National Quality lamp works will be in a position to furnish high-class direct-by-mail advertising pieces, free of charge, for its central-station customers' use. Salesmen may obtain portfolios, containing samples of all of these pieces, and yet small enough to slip into their grips. In the back of the book will be included a suggested series of follow-up letters for the use of central-station commercial departments.

Illustrations and copy for newspaper advertising campaigns will also be furnished gratis by the lamp manufacturers.

V. Field Men.

Pierre L. Miles, a practical central-station man will be on the staff of the Department of Publicity of the National Quality Lamp Division, and will act as a traveling expert to co-operate with agents and central stations in the planning of their advertising.

VI. Window Displays.

Miniature electrically lighted houses, lithographed cardboard window trims, revolving wheels embellished with light and color, will be suitable for window displays.

VII. Classified Publications.

There will be seven publications devoted to as many specific phases of lamp service, as follows:

1. Suggestions on Store Lighting.
2. Recent Developments in Electric Railway Lighting.
3. Steam Railway Lighting.
4. Street Lighting.
5. Steel Mill and Shop Lighting.
6. Textile Mill Lighting.
7. Diversified Industrial Lighting.

Flaming-Arc Lighting of Federal Street, Pittsburgh.

Federal Street, North Side, Pittsburgh, Pa., is the location of one of the latest developments in street illumination by means of long-burning series flame-arc lamps. The accompanying illustration, taken at night, gives a fair idea only of the intense illumination produced on this thoroughfare. Not only is the street bright enough to distinguish people several blocks away, but the ornamental poles from which the lamps are hung are a wonderful improvement over the old wooden poles formerly employed.

Flaming Arc Lamps on Federal Street, Pittsburgh.

The adoption of a new lighting system was brought about by the influence of the North Side Board of Trade of Pittsburgh. Just recently the grade of Federal Street has been raised considerably in order to place it above the flood level. Now with the street in a much better condition than previously, it was decided to complete the improvements with an up-to-date and efficient lighting system. The above system is the result of this determination.

The merchants were exceedingly anxious to make Federal Street attractive to customers, and easily convinced the City Council of the necessity of securing an appropriation for this installation. After having procured the appropriation, the committee visited several different cities to investigate the lighting systems employed therein.

After a thorough investigation, and upon the advice of competent illuminating engineers, the new flaming-carbon arc lamp recently placed on the market by the Westinghouse Electric & Manufacturing Company was adopted. This is the same lamp that was used to illuminate the hall at Baltimore where the National Democratic convention was held, and concerning which so much has been said. The illumination of this hall was such that the chairman had no difficulty in recognizing delegates in any part of the building when they arose to speak.

There are installed 90 lamps in all, each with the commercial rating of 3,000 candlepower. The street is 48 feet wide and the lamps are placed 60 feet apart. They are hung on ornamental poles of colonial pattern 25 feet high with ornamental goose necks.

It is claimed that Federal Street is now one of the brightest illuminated streets in the world.

Electric Lamp Contract.

The federal general supply committee has awarded the contract for furnishing electric lamps for the use of the Government to the General Electric, Westinghouse and Franklin Electric Companies. Lamps for every government department and for the use of the Army and Navy come under the provisions of this contract, which provides $400,000 for the purpose.

A NEW SYSTEM OF ILLUMINATION TO AVOID GLARE BY DIFFUSION.

By Hans K. Ritter.

There are three distinct devices which are utilized to make up a modern illuminant: first, the source of light or lamp; second, the reflector or redistributer of light; third, the diffuser or softener of light. It is the combination of these three devices into an efficient unit, its framing into a supporting structure or fixture, and the final application to our many varied needs, that are the problems of the illuminating engineer of the present day.

The tungsten lamp, mercury arc, etc., have all distinct distribution characteristics of light flux emitted by them, inherent to them; that is, they are dependent on the mechanical arrangement of the light-emitting surfaces.

Fig. 1.—General Appearance of the Ritter Unit.

These characteristics cannot in general be adjusted so that a fully satisfactory light distribution for all the necessary applications of the lights is found. To accomplish the latter, the first accessory mentioned or reflector is now universally used. Most modern illuminants have such a high intrinsic brilliancy that a correction is necessary to make them agreeable to our eyesight. To accomplish this, diffusing envelopes, such as globes, spheres, etc., are widely used.

At the present time, it is common practice to combine lamp and reflector, or lamp and diffusing globe. In combining lamp, reflector, and diffuser efficiently, many difficulties arise, as all know who have seriously attempted to make this combination. The failure to create such a unit accounts for the deficiency of many lighting installations. It is a comparatively easy matter to make a reflector for a certain redistribution of light, but a much harder task is set if the reflector is to act as diffuser and efficiently shield the glaring source of light. Most of the diffusing globes diffuse the light, but have no action in redistributing it efficiently.

However, to make certain a fully satisfactory arrangement, we are bound to combine lamp, reflector, and diffuser into one unit and thus produce an illuminant which is hygienic and fully satisfies our demands for ease and comfort.

Many attempts have already been made to successfully solve this problem. The most common of them is the frosting of the electric lamp bulbs; but this remedy cannot be said to fully cover this problem, as the frosting leaves the reflector surface unscreened within the field of vision, and even then the lamp's intrinsic brilliancy is high. Incidentally, sand-blasting the bulb tends to diminish the effective life of the lamp. It is therefore better to use clear-glass bulbs, screened by a diffusing envelope large enough to keep the intrinsic brilliancy down. Another method employed to screen the source of light is by means of indirect illumination. An investigation of this method shows that it cannot be generally adopted, as its applicability and efficiency, in most cases, are dependent on the preparation of ceilings and walls.

It was about the time when the Nernst lamp was at its height, and especially used for better lighting, that in the firm of Ritter & Uhlmann in Basel, fixture manufacturers of note in Switzerland, research tests were conducted under the direction of J. J. Ritter to find an arrangement which would embody in an efficient and proper manner the three fundamental components, namely, lamp, reflector, and diffuser combined in one unit.

The relation of many problems which arose in the practical and artistic application of fixtures to illumination and which had to be solved, was responsible for the creation of many new shades and types, and these efforts resulted finally in the invention of the patented combination described here.

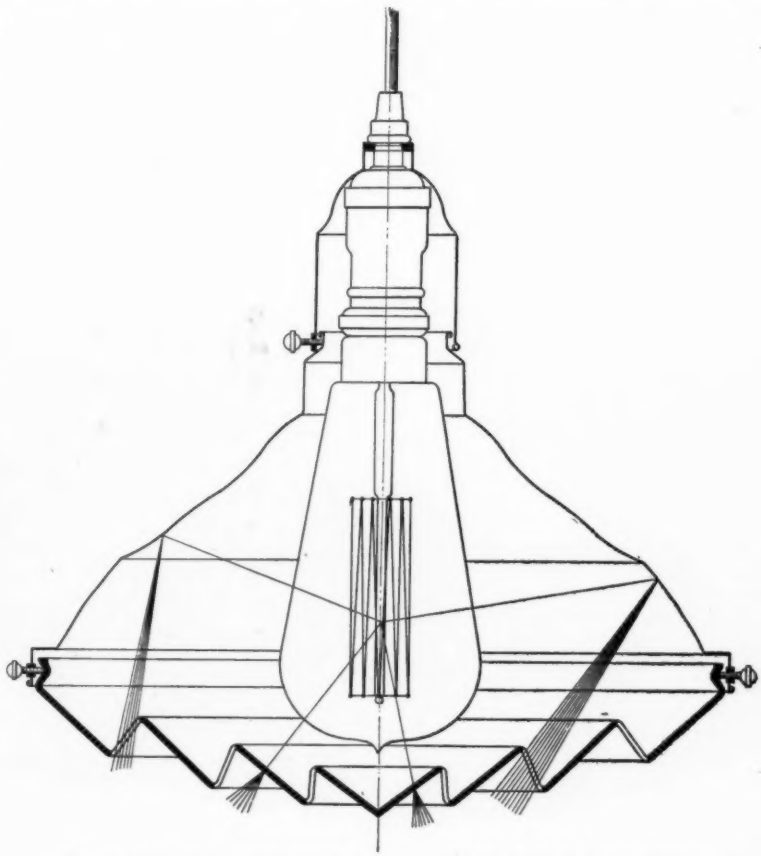


Fig. 2.—Section Showing the Arrangement of the Reflector and Diffuser.

In principle, this combination comprises an upper reflector and a lower glass distributer or diffusing envelope. These totally inclose the light source in such a manner that no direct rays from the filament leave the fixture without coming from one or the other of the supplementary diffusing surfaces, the attached translucent glass, or the matt reflector within.

The lower disk, see Figs. 1 and 2,

is made up of concentric, truncated cone surfaces, alternately erect and inverted. This embodies the fundamental principle of this invention. The inwardly sloping surfaces of the inverted cones are matted. The outwardly sloping surfaces of the erect cones are of clear glass.

Direct rays from the filament pass through the inwardly sloping cone surfaces of the diffuser, which are matted so as to completely hide the source of light. While this translucent surface hides the image of the filament, it is not dense enough to affect the efficiency greatly.

Rays which do not go directly from the filament to the diffuser, strike the reflector surface. From this they are reflected back downward and pass out through the outwardly sloping cone surfaces of the glass, which are clear. Again, those rays which are reflected from the matted surface of the diffuser, strike the reflector, and from there pass out through the clear glass of the diffuser. This class of rays deserves more attention than is usually given to it, and it adds materially to the efficiency of the combination. A maximum outlet for the whole spherical flux is thus provided through the lower surface, most of the light undergoing only a single diffusion. This, in addition to the correct matting of the translucent surfaces, contributes to the unusual high efficiency of this combination.

Any desired light distribution can be effected, as this depends entirely on the shape of the reflector and the position of the lamp in relation to it; not on the diffuser, as some might be led to expect.

Absorption in the diffuser amounts to 3.7 per cent of the total light flux. The efficiency is supplemented by other favorable points in this combination. The unit is practically dustproof. No dirt can hang on to the inner diffusing or reflecting surfaces, so the maintenance cost is low.

The size of the diffusing envelop depends upon the size of the lamps used, so that for a small lamp small units are made and for large lamps, large ones.

From no point beneath the fixture can the filament itself be seen through the clear-glass surfaces. Eye protection is therefore afforded to the fullest extent.

Innumerable applications can be made of this unit when suspended vertically; but with the advent of the wire-type tungsten lamp no necessity exists to use these lamps only in a vertical or upright position. By means of the patented diffuser described, we can with equal efficiency employ the lamp at any desired position.

It is widely known that sources of light distributed in a given space and employing one type of reflector hanging vertically give an even light distribution only when given a certain spacing distance and placed above a certain height.

For a light source in a reflector placed on an angle, the light distribution being of the focusing type, it is different. Here we are only concerned to find the angle which would correspond to an even illumination of a zone on the working plane, and any lowering or raising of the fixture does not affect the even distribution of light in one zone on the actual working surface.

Material saving of light is thereby effected, as the highest intensity is actually brought in the working zone. Further, by using a cluster there results a saving in the number of outlets required.

For instance, in the conditions considered, with two 60-watt lamps, each placed in a unit as described and standing at 45 degrees against the vertical, thus being grouped as a cluster, the spacing distance would be about 15 feet, with a vertical hanging distance of 6 feet 6 inches from the working plane.

In Fig. 3 is shown a fixture built up of the above units, which is designed for use as a church fixture. This fixture is built up of the following: First, a group of six diffusers placed at 45 degrees to the vertical, each 12 inches in diameter, and inclosing one 100-watt tungsten lamp; second, one diffuser placed vertically 16 inches in diameter and holding three 100-watt tungsten lamps; third, three reflectors each holding one 60-watt tungsten lamp, these being used for ceiling illumination.

From the picture it can be noted that the framework of the fixture is such that the reflectors are hidden from view. The bulbs of the electric lamps are also covered up and a compact and efficient arrangement is found in which all parts serve a useful purpose, readily adaptable to decoration. Many styles of fixtures can be created, almost all of which appear artistic and attractive in form.

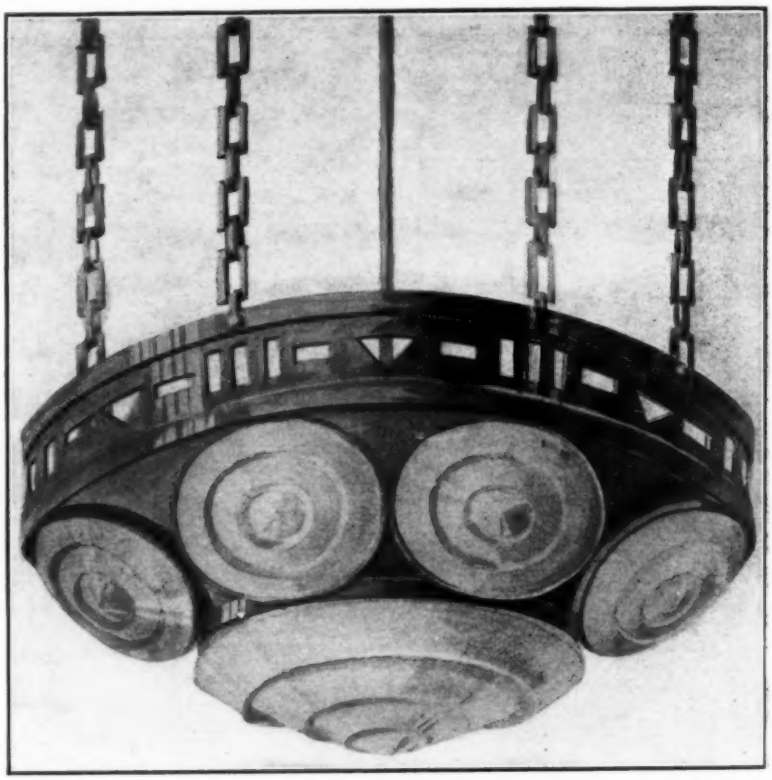


Fig. 3.—Large Fixture With Several Units.

The principle laid down through the combination of lamp, reflector and an efficient diffusing envelope is not exhausted. The field for application is a very large one to employ these means to eliminate glare. The combinations and applications of these units are so numerous that it is almost in order to call it a new system of illumination created through the employment of a diffusing envelope having a very high efficiency in connection with reflector combined into one harmonious unit.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

LESTERVILLE, S. D.—The Commercial Club favors an electric light plant. C.

NEW LONDON, MINN.—The village has decided to install an electric light plant. C.

WILTON, N. D.—The City Council is considering installing a number of street lights. C.

CHARLESTON, S. C.—North Charleston Water & Light Company plans to build an electric plant.

LINEVILLE, IOWA.—Bonds have been voted in Lineville for the installation of an electric light plant.

FLORESVILLE, TEX.—This city has granted a franchise for an electric plant to J. H. Spencer and associates.

LOUISVILLE, KY.—Louisville Lighting Company contemplates extending its transmission lines to Anchorage.

GILMORE CITY, IOWA.—This city has voted to grant a franchise for electric lighting to R. W. Heath. C.

GOLDFIELD, IOWA.—This city has granted a franchise to the Citizens' Light Heat & Power Company. .C

HOPKINS, MINN.—The Consumers' Power Company has been granted a franchise for electric light and power here. C.

WILMORE, KY.—Wilmore Light & Ice Company will rebuild its plants which were recently burned, causing a loss of $10,000.

PLYMOUTH, IND.—The City Council has under consideration the question of installing a municipal lighting plant to cost $40,000. S.

PEORIA, ILL.—If an electric light plant can be secured for about $3,500 the Board of Supervisors will install one at the county farm.

DALLAS, TEX.—Missouri, Kansas & Texas Railway, of which A. M. Acheson is chief engineer, will construct a power plant at Smithville.

HUBBARD, IOWA.—This city has granted a franchise to the Park Dam Company of Eldora, to build transmission lines here.

SIDNEY, ILL.—W. S. Thompson has been granted a franchise by the Village Board to run a pole-and-wire line, and to sell electricity in the village.

ARANSAS PASS, TEX.—This city has arranged for the construction of an electric light plant. For further particulars address the mayor.

VERGENNES, VT.—The Burlington Traction Company is negotiating to supply electricity to villages along its route between Burlington and this place.

DANVILLE, KY.—H. C. Wood, who has recently purchased the Danville Light, Power & Traction Company, will greatly enlarge and improve the plant.

EAU GALLIE, FLA.—This city has granted a franchse to Indian River & Lake Worth Company to supply electricity for lighting streets and residences.

HOBART, IND.—Plans are being made for the installation of a modern system of street lighting on Main, Front and Fourth Streets, and along the new boulevard. S.

OTTAWA, ILL.—The La Salle County Board of Supervisors has granted the La Salle County Electric Company a 20-year franchise to operate its line along the highways.

ST. PAUL, MINN.—It is planned to install a lighting plant at the Detention Hospital at this place. Health Commissioner Lankester believes that one can be installed for $300.

MOUNT VERNON, KY.—J. E. Shoop and David Phelps, of Danville, Ky., have perfected plans for the establishment of an electric light and power plant in this city. G.

RAGLAND, ALA.—Ragland Water Power Company is reported as about to begin construction of a hydroelectric plant, developing 6,000 to 10,000 horsepower, costing about $500,000.

CLOVERPORT, KY.—Cloverport Ice Company, which has been incorporated with a capital stock of $12,000, will install an electric light plant. A. A. Simons is president of this company.

MARBLE ROCK, IOWA.—This city has under consideration issuing bonds for a water-power system and an electric generating station, estimated cost of which is $17,000. C.

EDDYVILLE, KY.—A movement is afoot to reorganize and enlarge the municipal electric light and power plant so as to permit an extension of Eddyville's street lighting system. G.

PIERRE, S. D.—The Eastern Iowa Consolidated Light & Power Company has been incorporated with a capital stock of $300,000 as a foreign corporation to engage in business in Maquoketa.

PERRYVILLE, KY.—W. J. DeBaun is completing plans for the erection of an electric light and power plant in connection with a creamery and ice plant which he is operating in that city. G.

LOS ANGELES, CAL.—The Arrowhead & Power Company has applied for permission to issue $4,000,000 in bonds to be used to construct a dam in Little Bear Valley to develop power and also to store water for irrigation.

EVANSVILLE, IND.—The mayor and other city officials are planning a 15-per-cent tax for the purpose of building and equipping a $350,000 municipal electric light plant. The city is now paying $50,000 a year for lights.

LONG ISLAND CITY, N. Y.—The Long Island Railroad Company is preparing to build an electrical substation in the Murray Hill section of Flushing. This station will supply power for the North Shore electrification.

SAINT PETERSBURG, FLA.—The local electric light, power and railway company, of which Thomas K. Bell is the new superintendent, will, it is stated, within a year move the plant to a new location and add considerable new machinery.

EDGERTON, WIS.—The business men of this place are planning an ornamental system of street lighting to be placed along the newly paved streets of Edgerton. The system under consideration consists of 15 cast-iron octagon posts of five lamps each.

DOVER, N. H.—The report of the Standing Committee on Light which was made to the City Council last June, has been unanimously adopted, whereby there will be a revision in the system of street lighting here, all expense to be borne by the street lighting company.

LEWISTON, MONT.—A franchise has been granted to the Kendall Light & Power Company to run an electric line from their power plant on Warm Springs Creek to Hilger, *via* Brooks. The franchise stipulates that work must be commenced before November 1

MONTICELLO, MINN.—The village has under consideration the installation of an electric light plant at a cost not to exceed $10,000. It is said that there is a strong sentiment in favor of electric lighting as the present system of gas has been very unsatisfactory.

ALBUQUERQUE, N. M.—D. C. Collier of San Diego, Cal., and associates, who recently purchased a large tract of land near here, will construct a dam for the purpose of creating a large water-storage reservoir and will install a hydroelectric plant. They will colonize the tract with farmers. D.

SWEETWATER, TEX.—Western Texas Electric Company has been incorporated with a capital stock of $360,000 for the purpose of dealing in gas and electricity in various counties in this state. The incorporators are J. D. Oliver, Walter Graner, H. I. Gahagan, J. D. Caldwell, G. H. White, all of Dallas.

MATTOON, ILL.—The Central Illinois Public Service Company has been granted a 50-year franchise by the village board, at Neoya, and will build a transmission line to that village and to Etna. The line may be extended to Effingham. A 10-year contract for lighting the streets at Neoya has been closed. Z.

VALPARAISO, IND.—The citizens Mutual Light, Heat and Power Company has filed articles of incorporation and is capitalized at $100,000. The company proposes to construct and operate a light, heat and power plant to supply the city of Valparaiso. Charles E. Foster, John W. Steb, James H. McGill, John M. Mavity and George Dodge are directors.

SALINEVILLE, O.—The Salineville Electric Light Company has announced its intention to at once rebuild its plant, which was recently destroyed by the flood. Some of the machinery, which was buried in the mud and sand, is being recovered, but the company is at present unable to determine just what the full extent of the loss is, although it is heavy.

CLEVELAND, O.—Sealed proposals will be received at the office of the Secretary to the Director of the Public Service, No. 104, City Hall, Cleveland, O., until October 10, for furnishing and installing three 5,000-kilowatt steam turbogenerators, complete, for the municipal electric light plant, this city. Copies of plans and specifications may be had from the office of the Engineer of Construction, City Hall.

BINGHAMPTON, N. Y.—The proposition for the county to install a system of boulevard lights in Court House Square will come before the Board of Supervisors at a meeting to be held early next month. It is proposed to place about 20 boulevard light standards with three large incandescent lamps on each standard on certain streets of the city. The estimated costs of this improvement is $2,500.

BRISTOL, TENN.—The Bewley-Darst Coal Company is promoting an enterprise to build a large power plant, at a cost of $250,000, in St. Charles, which is in the heart of the mining district. The power plant will be on the unit system, each unit being 1,000-kilowatt capacity, and it is stated that power will be furnished to the operators at a cost much less than that of producing it by the present small individual plants scattered throughout the field. The capital for this undertaking has all been subscribed.

SAN FRANCISCO, CAL.—The State Railroad Commission has authorized the issuance by the Pacific Gas & Electric Company of $5,000,000 of general and refunding five-per-cent bonds for the purpose of constructing a 55,000 horsepower hydroelectric plant on the Bear River and the installation of a new double-circuit steel-tower power line to the center of the company's system. The bonds have been secured by J. P. Morgan & Company and will be handled in the East by N. W. Harris & Company and locally by the N. W. Halsey & Company.

CONOWINGO, MD.—The residents of this place have been notified by the Susquehanna Power Company, which owns all the houses and lands here, to vacate their homes and it is understood that a large dam will be built across the Susquehanna River at this point and a large plant erected for the purpose of generating electricity. It is believed in financial circles that the Pennsylvania Railroad is behind this enterprise and that it is the intention of this road to electrify its line through Baltimore and the tunnels. It will require $10,000,000 to carry out the construction work.

ANGOLA, IND.—The Angola Light & Railway Company and the Waterloo Electric Light & Water Works Company have been sold to the Indiana Utility Company. The purchasers will shut down the Waterloo plant and supply both towns with current from the Angola station. A complete new three-phase system has already been contracted for and the necessary transmission line will be erected at once. This line will also supply energy to the town of Pleasant Lake, Ind. The Indiana Utility Company is a Chicago organization and E. J. Condon, of this city, is its president and general manager.

SALT LAKE CITY, UTAH.—D. C. Jackling, vice-president and general manager of the Utah Copper Company, states that as a result of a contract now in course of preparation between the Utah Copper Company and the Telluride Power Company all power mechanisms operated in the mine in Bingham, the smelter at Garfield, the mill at Magna and all pumping plants connected with these works, and also the Bingham & Garfield Railroad will be electrified. At the present time the Utah Copper Company is using about 6,000 horsepower of electric energy furnished by the Telluride Company, but under the new contract the necessary electric energy will amount to about 14,000 horsepower.

OTTAWA, ONT.—It is announced that plans are being perfected for the future electrification of the new Hudson Bay Railway. It is said that a hydroelectric plant will probably be constructed at White Mud Falls, which is about half way between Lake Winnipeg and Hudson Bay. This section of Canada abounds with waterfalls which are available for hydroelectric generation. The Conservation Commission of Canada estimates that there is easily available in this territory 6,000,000 horsepower. This power can be generated very much cheaper than operation by steam. Plans are being considered also for utilizing this great hydroelectric power in the western provinces under much the same regulations by which the Ontario Hydro-Electric Commission now controls the power at Niagara and other locatons in the province of Ontario.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

FOSSTON, MINN.—The Garden Valley Telephone Company will install local lines at once. C.

LESIE, MICH.—The Bailey Telephone Company has been incorporated with a capital stock of $210.

ST. CLOUD, MINN.—The city voted to admit the Tri-State Telephone Company for long-distance connections.

PICKFORD, MICH.—The Pickford Telephone Company has been incorporated with a capital stock of $10,000.

SHOSHONE, IDAHO.—A line is being surveyed from Mountain Home to this city by the Mountain States Telephone & Telegraph Company.

ABERDEEN, S. D.—The Dakota Central Telephone Company will expend $50,000 this fall in improving its equipment in South Dakota and Southern North Dakota. C.

ABERDEEN, WASH.—Cohasset Beach Telephone Company has been incorporated with a capital stock of $1,000 by J. B. Benson, W. C. Mumaw and H. B. Waldron.

DEWAR, OKLA.—The Dewar Telephone Company has been incorporated with a capital stock of $3,000 by W. C. Brymer, J. W. Fowler and F. M. Pearson, all of this place.

RENO, NEV.—The Sierra Telephone & Telegraph Company, whose incorporators are T. F. Dunaway, H. G. Comstock and E. F. Brown, is seeking a franchise in this city.

CLEBURNE, TEX.—The Cleburne Bono Telephone Company has been incorporated with a capital stock of $2,000. The incorporators are I. R. Carper, W. M. Hickman and L. E. Davis. Z.

CAMPBELL, S. C.—Campobello Telephone Company has been incorporated with a capital stock of $1,000. The incorporators are J. M. Jackson, T. E. Gibson, J. B. Caldwell and N. T. Clark.

GRUNDY CENTER, IOWA.—The Grundy Center Mutual Telephone Company seeks a franchise and offers to build a central-energy system and other improvements to cost $15,000.

WINNEMUCCA, NEV.—The Golconda Telephone & Power Company, has applied for a franchise for a telephone, electric light and power line from this city to National, via Paradise.

THIEF RIVER FALLS, MINN.—An engineer has been engaged by the city to prepare plans for a modern municipal telephone system. The report will be given to the council within a short time. C.

BOWLING GREEN, KY.—A petition is being circulated among the citizens here asking that the city council pass an ordinance providing that all telephone wires in Bowling Green be placed underground. G.

KENOSHA, WIS.—It is reported that local men have up with the Chicago Automatic Telephone Company the matter of installing an automatic telephone service in this city and that arrangements will in all probability be made.

SAN FRANCISCO, CAL.—The Supervisors passed the declaratory ordinance setting forth the intention of the Board to secure from the City Engineer plans for the creation or acquisition of a municipal telephone system.

SHENANDOAH, IOWA.—The Mutual Telephone Company has bought the local Bell lines and has sold toll lines to the Bell. The Mutual will merge the two exchanges, install new switchboards and make other improvements. C.

LYNCHBURG, S. C.—Lynchburg Telephone Company has been incorporated with a capital stock of $3,000. The incorporators are J. Hardy, I. C. Strauss and Robert Shelor. The company has been merged wth the Sumter Telephone Company of Sumter, S. C., which will establish plant.

JANESVILLE, WIS.—A committee of stockholders of the Rock County Telephone Company has in charge the matter of deciding on a telephone system for Janesville. The automatic system seems to be favored by a majority and it is expected that the central-energy system will be adopted for this place.

OAKES, N. D.—The Dakota Central Telephone Company is spending $10,000 in this vicinity in improvements. The work is in charge of William Webster, construction foreman, whose headquarters are in this city. A new line is being built to Cogswell, and a new copper line is being strung to La-Moure.

AUGUSTA, ME.—The Belgrade Telephone & Telegraph Company has been incorporated with a capital stock of $10,000. The incorporators are Joseph Williamson and E. M. Hussey, Augusta, and E. M. Leavitt, of Winthrop. It is proposed to construct and operate telephone lines within the counties of Kennebec, Franklin and Somerset.

ELECTRIC RAILWAYS.

(Special Correspondence.)

CEDAR RAPIDS, IOWA.—The street railway will extend its tracks on North Sixteenth street. C.

COLUSA, CAL.—The time of the expiration of the Northern Electric franchise has been extended from September 13, 1912, to January 31, 1913.

SAN ANGELO, TEX.—Local citizens are promoting the organization of a company for the construction of an interurban electric railway between San Angelo and Christoval. D.

SOUTH FORK, PA.—A charter has been issued to the South Fork Portage Street Railway Company, which will build five miles of line between South Fork and Wilmore. The capital stock is $48,000.

LOS ANGELES, CAL.—The Pacific Electric Company has plans, it is stated, for the construction of a double-track electric line from Watts to a point on the Southern Pacific railroad directly east.

JANESVILLE, MINN.—The Sioux Falls & Southern Minnesota Traction Company has made a proposition to extend a line through here from Wells to Alma City and Janesville to the Twin Cities. C.

PROVO, UTAH.—The City Commission has extended the franchise of the Evans-Chipman interurban railroad people until December 31, 1914, by which time it is stipulated one mile of track must be built through Provo.

OLEAN, N. Y.—Charles D. Judd, of this city, is interested in the project which is on foot to extend the trolley line from here to Hinsdale, a distance of seven miles. It is said that the right of way is being secured.

HARRISBURG, ILL.—A franchise has been granted to the Illinois Railway & Power Company for the building of an electric line in this city. Work is to begin at once and the entire line to be completed within a year.

LOUISVILLE, KY.—The Louisville Street Railway Company has been making surveys with a view to extending its line to West Point. It has been definitely determined, however, to extend the line to Kosmosdale, a distance of three miles.

BURLINGAME, CAL.—Andrew M. Easton, founder of the town of Easton, has contracted with Mahoney Brothers, San Francisco, for the construction of a street railroad to run from the Easton Station on the Southern Pacific to the foothills.

ROME, N. Y.—The Rome & Oneida Railroad Company has up with the Railroad Commission the right to construct an electric road from Rome, through Westmoreland and Verona, to the city of Oneida, a distance of 13 miles altogether.

SAN BERNARDINO, CAL.—A Chamber of Commerce committee has been appointed to raise $35,000 as a bonus for a section of the right of way between this city and Rialto, as part of the Pacific Electric's through trunk line from here to Los Angeles.

TACOMA, WASH.—City Engineer Raleigh has submitted a report to the mayor of Tacoma stating that it will necessitate an expenditure of $87,500 for a municipally owned car line from Pacific Avenue to the dock of the Chicago, Milwaukee & Puget Sound Railway Company.

MUSKEGON, MICH.—John Q. Ross and a committee of Muskegon citizens have local charge of a project, with Chicago promoters, to build an interurban line between Muskegon, Ludington and Manistee. The promoters want the towns along the right of way to raise a bonus of $280,000.

BOONVILLE, IND.—The directors of the Evansville, Christney & Eastern Traction Company have decided to begin work on the extension leading from Boonville to Christney and Lynnville. The survey of the two lines has been completed and it is expected that cars will be running by January 1.

GLOBE, ARIZ.—N. L. Amster of Boston, Mass., and the Inspiration Copper Company are both engaged in strong competition in the matter of being the first to construct an interurban electric railway between Globe and Miami, a distance of six miles. Both these interests are making preliminary surveys for the proposed line. D.

CONNELLSVILLE, PA. — News from the office of Assistant Right of Way Agent Zundel of the West Penn Traction Company at this place is that the company will build a trolley line from Boston along the Youghigheny River to Elizabeth, and that application for franchises in the towns along the right of way are being prepared.

SALT LAKE CITY, UTAH.—The railroad line between Salt Lake City and Saltair Beach is to be electrified before the end of the year and an improved service installed. At Saltair the line will be connected with the Bingham & Garfield Company from which the Saltair line will purchase power. The Bingham line will be extended from Garfield to the beach.

BARTLESVILLE, OKLA.—The John B. Daugherty Company has purchased the interurban line of the Bartlesville-Dewey Company. With the transfer of the property announcement is made that a through connecting interurban line to Kansas City is probable within the next two years. The new company will however, begin at once the extension of the line to Caney, Kan., a distance of 16 miles.

MORGANTOWN, W. VA.—A charter has been granted to the Morgantown & Wheeling Railway Company, capitalized at $1,000,000. The incorporators are Julius K. Monroe and E. M. Lantz, of Kingwood; T. D. Stewart, J. M. Gregg and D. M. Wilns, of Morgantown. The company will build an interurban railway between Morgantown and Wheeling, passing through Marshall and Ohio Counties.

PHILADELPHIA, PA.—Transit Commissioner A. Merritt Taylor is at present considering plans for a subway on Broad Street from the Philadelphia Navy Yard to Olney Avenue, and elevated systems along certain streets of the city. Mr. Taylor has suggested these improvements in addition to those which are being considered for the transportation betterment of a "Metropolitan Philadelphia," the transit facilities within a radius of 16 miles of the City Hall.

VELASCO, TEX.—S. F. George, of Dayton, O., has established offices in Houston for the purpose of promoting the construction of an interurban electric railway between Houston and Velasco, via Manvel, Liverpool and other small towns, a distance of about 85 miles. The preliminary survey is now in progress. The route is through a territory that is not now within close reach of existing steam railroads, but it contains a population of considerable density. It is stated by Doctor George that the interurban railway project has been financed and that its construction is assured. D.

HOUSTON, TEX.—Plans for the building of an interurban electric railroad from Houston to La Porte, *via* South Houston, are about completed and receipts for the right of way have been deposited with the Union National Bank of Houston. The franchises agreed upon call for the completion of the line by June, 1913. Articles of incorporation have been prepared for the new company, which will be known as the South Texas Traction Company, and will be filed with the Secretary of State at once. It is estimated that the cost of constructing the road will be $650,000.

MICHIGAN CITY, IND.—The Michigan City, Lakeside & St. Joseph Electric Railway Company has filed articles of incorporation in St. Joseph, Mich., with a capital stock of $750,000. The company is busy obtaining rights of way in Lake, Weesaw and Chikaming Townships and Berrien County, Mich., and, it is stated, is meeting with much encouragement from the property owners. It is planned to commence actual work of construction this fall and continue as long as the weather permits. The directors are G. C. Marsh, P. C. Cramer, Eugene Shedd, H. Bussan, Otto Egloff, Melvin R. Wadsworth and J. H. McMillan.

NEW INCORPORATIONS.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Presto Electric Company with $500,000 capital stock, by S. A. Fairchild, M. Meagher, E. Barats, S. J. Brun and J. W. Schmitz.

NEW YORK, N. Y.—New York Electric Sign Company has been incorporated with a capital stock of $25,000. The incorporators are William Abramson, Howard A. Scholle, New York City and A. Ehrlich, Brooklyn, N. Y.

NEW YORK, N. Y.—Dow Jones News Transmission Company has been incorporated with a capital stock of $10,000 by Clarence W. Barron and Jessie M. Barron, both of Cohasset, Mass., and Hugh Bancroft, of Boston, Mass.

NEW YORK, N. Y.—Standard Electric Incubator Company has been incorporated with a capital stock of $100,000. The incorporators are John G. Congrave and William R. Greenway, New York City; Mark W. Davis, Newark, N. J.

NEW YORK, N. Y.—Judson-McCarthy-Lowe Company has been incorporated with a capital stock of $20,000 to engage in electrical contracting. The incorporators are George E. Judson and Joseph F. McCarthy and William Lowe, all of New York.

PETERSON, IOWA.—The Peterson Power & Milling Company has filed articles of incorporation with a capital stock of $40,000. The directors of the company are A. M. Jones, D. McMillan, A. O. Anderson, W. E. Landsberg and E. L. Mantor. This company will furnish light and heat and do a general milling business.

FINANCIAL NOTES.

So far as the stock market is concerned, a review of leading industrials indicates a more active interest both from speculative and investment viewpoints. There is also evident a tendency toward increasing prices. The reports of business improvement continue and the persistence of favorable weather conditions renders more certain of harvesting record crops in all forms of produce. Railroads, however, due to the economies of the past two years, may be in difficulties in bringing their equipment up to the capacity that will be required to handle the enormous tonnage.

At a meeting of the stockholders of the Louisville Gas Company, of Louisville, Ky., which controls the Louisville Lighting Company, action was taken which finally transfers the two utilities to the control of H. M. Byllesby & Company, of Chicago, the city of Louisville having sold its holdings in the Louisville Gas Company a couple of months ago for $1,387,000. The old directorate of the company was retired and a new one was elected. George H. Harries, who has been president of the company under the Byllesby regime, was retained in that office. Mr. Byllesby who was not present at the recent meeting, was elected a vice-president. Three of the original members of the directorate, James B. Brown, John H. Whallen and W. J. Abram, were retained in their positions, Mr. Brown also advancing to a vice-presidency. The personnel of the board, including President Harries and Vice-Presidents Byllesby and Brown, is as follows: W. J. Abram, A. S. Huey, J. J. O'Brien, O. E. Oschoff, John H. Whallen and F. W. Stearns. Most of the out-of-town stockholders of the gas company were represented by proxies held by General Harries.

The Merchants' Public Utilities Company, of Indianapolis, Ind., recently organized, has contracted for the sale of preferred stock of the par value of $1,000,000 through Henning Chambers & Company and L. C. McHenry & Company, both of Louisville; and George Eustice & Company, of Cincinnati, O. The holding company is incorporated with $4,000,000 capital stock, of which $2,000,000 is in preferred and $2,000,00 in common stock. It has re-financed the Merchants' Light & Heat Company, of that city. A merger with the Indianapolis Light & Heat Company is rumored. The new company, it is specifically set forth, is not affiliated with the Byllesby interests nor indeed with any outside of Indianapolis except in the floating of preferred stock. Edwin L. McKee and other Indianapolis capitalists are interested.

The Springfield & Central Illinois Traction Company has arranged for the financing of the interurban railway which it intends to build to Decatur, Sullivan, and Matoon. This line was projected a number of years ago, but was not successfully financed. The present company has taken over the assets of the former company, which failed.

The report has been practically confirmed by financial men interested that E. A. Robert, president of the Montreal Tramway Company, and a number of influential Montreal business men, have purchased the Halifax Electric Street Railway, paying $160 a share for the same. The deal is to be completed about October 25.

Nelson, Cook & Company, of Baltimore, are offering $100,000 of the Lehigh Valley Transit Company five-per-cent refunding bonds. These bonds are dated June 1, 1910, and run for 50 years. They are redeemable at 105 and interest, after June 1, 1920. The Lehigh Valley Transit Company owns and controls 160 miles of electric railway, and also owns a controlling interest in electric light and power companies in a number of small cities in Western Pennsylvania. The bonds are offered at 91.5 and interest, to yield 5.5 per cent.

Townsend, Scott & Son, of Baltimore, are offering $400,000 first-mortgage five-per-cent bonds of the Danville Traction & Power Company. These bonds are redeemable at 107 and accrued interest upon any interest date. The Maryland Trust Company is the trustee. The city of Danville, which is located in Pennsylvania county, Va., on the main line of the Southern Railway, is the second largest manufacturing city in the state of Virginia, and is one of the biggest loose-leaf tobacco markets in the world. There are located in this city several cotton mills which employ from four to five thousand operators, and the population has been rapidly growing.

J. P. Morgan & Company have purchased $10,000,000 five-per-cent debenture bonds of the General Electric Company. These bonds are part of an authorized issue of $60,000,000 created last July at the time of the 30 per-cent-stock dividend. At that time directors in their official announcement of this stock dividend said: "For the future financial needs of the company it is proposed to issue debentures from time to time, and for this purpose the board of directors has authorized an issue of debentures bearing interest at five per cent or less, the total to be limited to $60,000,000." It is stated that the proceeds of the new issue are to be used in strengthening the company's working capital. The company's business is expanding at a very rapid rate, gross for this year being at about a $93,000,000 per annum rate, against $70,000,000 in 1911. At the close of the last fiscal period the company had a cash balance of approximately $18,000,000, which, together with other current assets, made total working assets of about $66,704,000.

Harris, Forbes & Company, New York, are offering $1,687,000 first-refunding-mortgage five-per-cent bonds of the Iowa Railway & Light Company. These bonds are dated August 30, 1912, and are due September 1, 1932. After September 1, 1915, they may be called by the company at 103 and interest. The bankers are offering them at 97 and interest. The Iowa Railway & Light Company owns and operates without competition the electric light and power properties of Cedar Rapids, Marshalltown, Boone, Marion, Terry, Tama and Toledo. It owns a high-grade interurban electric railroad and furnishes the city service in the towns mentioned. In addition it has several gas plants and heating properties. Franchises have been secured in a number of adjacent towns and the company intends to extend its line throughout the entire section. The franchises in the cities are for long terms and the company's interurbans are operated over private rights of way.

Lawrence Turnure & Company, New York, are offering to the public an issue of first-mortgage six-per-cent gold bonds of the Santiago Electric Light & Traction Company. This offer is made at 98.5 and interest. These bonds are due Jan. 1, 1959, and are redeemable at 105 and interest on any interest date after Jan. 1, 1919. The company owns eleven miles of standard gauge railway in principal streets of Santiago, Cuba, and reaches all the suburbs, including a well patronized amusement park. The earning report for the year 1911 showed $366,916 gross, and net of $171,468. This was after taxes and other fixed charges had been deducted. In the first seven months of 1912, gross earnings amounted to $227,964, or an increase of about thirty per cent over the previous year. Both the principal and interest are payable in gold at the Equitable Trust Company, New York, which is the trustee under the mortgage.

Dividends.

American Power & Light Company; a quarterly preferred dividend of 15 per cent, payable October 1 to stock of record September 25.

American Telephone & Telegraph Company; a quarterly dividend of two per cent, payable October 15.

Asheville Power & Light Company; a quarterly preferred dividend of 1.75 per cent, payable October 1.

Aurora, Elgin, Chicago Railway; a common dividend of 0.75 per cent, and a preferred dividend of 1.5 per cent, both payable October 10.

Augusta-Aiken Railway & Electric Company; a quarterly preferred dividend of 1.5 per cent, payable September 30.

Bangor Railway & Electric Company; a quarterly preferred dividend of 1.75 per cent, payable October 1.

Bell Telephone Company of Canada; a quarterly dividend of two per cent, payable October 15.

Buffalo General Electric Company; a quarterly dividend of 1.5 per cent, payable September 30.

Butte Electric & Power Company; a

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Sept. 23.	Sept. 16.
American Tel. & Tel. (New York)	144½	143⅝
Commonwealth Edison (Chicago)	138½	138½
Edison Electric Illuminating (Boston)	290	290
Electric Company of America (Philadelphia)	* 12¼	* 12¼
Electric Storage Battery common (Philadelphia)	56¾	56¾
Electric Storage Battery preferred (Philadelphia)	56¾	56¾
General Electric (New York)	182¾	180½
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	2	2⅛
Massachusetts Electric common (Boston)	18¾	18½
Massachusetts Electric preferred stamped (Boston)	76½	76
National Carbon common (Chicago)	127	119
National Carbon preferred (Chicago)	117½	117¼
New England Telephone (Boston)	153½	153
Philadelphia Electric (Philadelphia)	24¼	24
Postal Telegraph and Cables common (New York)	87½	85½
Postal Telegraph and Cables preferred (New York)	68½	68⅝
Western Union (New York)	81	81
Westinghouse common (New York)	85⅞	87
Westinghouse preferred (New York)	*125	125

*Last price quoted.

quarterly common dividend of 1.75 per cent, payable October 1.

Carolina Power & Light Company; a quarterly preferred dividend of 1.75 per cent, payable October 1.

Cincinnati, Hamilton & Dayton Traction Company; a common dividend of 0.875 per cent, and a preferred dividend of 1.25 per cent, both payable October 1.

Cities Service Company; the regular monthly dividends of one-half of one per cent on the preferred and of one-third of one per cent on the common stock, payable November 1 to stockholders of record October 15. Hereafter the Cities Service Company will declare dividends one month in advance, the date for the closing of the books being changed from the 20th to the 15th of the month.

Cleveland Railway Company; a quarterly dividend of 1.5 per cent, payable October 1.

Consumers' Power Company; a quarterly dividend of 1.5 per cent, payable October 1.

Detroit Edison Company; a quarterly dividend of 1.75 per cent, payable October 15.

Eastern Michigan Edison Company; a quarterly dividend of one per cent, payable October 1.

Electric Storage Battery Company; common and preferred dividend of one per cent each, payable October 1.

Electrical Securities Company; a quarterly preferred dividend of 1.25 per cent, payable November 1.

Halifax Railway Company; a quarterly dividend of two per cent, payable October 1.

Houghton County Traction Company; a semi-annual common dividend of $2.50 per share, and a preferred dividend of $3, both payable October 1.

Kansas Gas & Electric Company; a quarterly preferred dividend of 1.75 per cent, payable October 1.

Manchester Traction, Light & Power Company; a quarterly dividend of two per cent, payable October 15.

Massachusetts Lighting Companies; a dividend of 1.75 per cent, payable October 15 to stock of record September 25.

Metropolitan West Side Elevated Railway Company; a dividend of three-fourths of one per cent on the preferred stock, payable September 30 to stock of record September 20.

National Gas, Electric Light & Power Company; a quarterly dividend of 1.5 per cent on the preferred stock, payable October 1, to stock of record September 25.

New Orleans Railway & Light Company; a quarterly preferred dividend of 1.25 per cent, payable October 1.

New York State Railways; a quarterly common dividend of 1.5 per cent, and a preferred dividend of 1.25 per cent, both payable October 1.

Niagara Falls Power Company; a quarterly dividend of two per cent, payable October 15.

Pacific Gas & Electric Company; a quarterly common dividend of $1.25 per share, payable October 15.

Philadelphia Company; a quarterly common dividend of 1.75 per cent, payable October 1.

Philadelphia Traction Company; a semi-annual dividend of $2, payable October 1.

Public Service Corporation of New Jersey; a quarterly dividend of 1.5 per cent, payable October 1.

Porto Rico Railway Company; a quarterly common dividend of one per cent, and a preferred dividend of 1.75 per cent, both payable October 1.

Puget Sound Traction, Light & Power Company; a quarterly common dividend of $1 per share, and a preferred dividend of $1.50 per share, both payable October 15.

Republic Railway & Light Company; the regular quarterly dividend of 1.5 per cent on the preferred stock, payable October 15 to stock of record September 30.

South Side Elevated Railway Company; a dividend of 1.125 per cent, payable September 30 to stock of record September 20.

Tri-City Railway & Light Company; a quarterly dividend of 1.5 per cent, payable October 1.

Washington, Baltimore & Annapolis Electric Railway; a preferred dividend of 1.5 per cent, payable October 1.

Washington Water Power Company; a quarterly dividend of two per cent, payable October 1.

Westinghouse Electric & Manufacturing Company; a dividend of one per cent on the common stock; for the quarter ended September 30. Six months ago one per cent was declared on the common stock. The regular quarterly dividend of 1.75 per cent on the preferred stock was also declared. The common dividend is payable October 30 to stock of record September 30, and the preferred is payable October 15 to stock of record September 30.

Reports of Earnings.

CITIES SERVICE COMPANY.

The Cities Service Company reports earnings for the twelve months ended August 31, 1912, as follows:

Gross earnings	$1,132,529
Net earnings	1,053,226
Preferred dividends	579,251
Common dividends	194,739
Surplus	279,235
Total surolus to Aug. 31, 1912,	$481,278.

BUFFALO GENERAL ELECTRIC.

Income account of the Buffalo General Electric Company for seven months ended July 31, 1912, compares as follows:

	1912.	1911.
Operating revenue	$760,539	$681,308
Expenses and taxes	458,792	417,237
Income from operation	301,747	264,070
Other income	24,872	27,179
Total income	326,620	291,250
Interest	94,237	86,429
Surplus	232,382	204,821

KINGS COUNTY ELECTRIC LIGHT & POWER.

The Kings County Electric Light & Power Company reports as follows for August and eight months:

	1912.	1911.
August gross	$ 375,821	$ 358,596
Net after taxes	100,529	121,881
Other income	2,113	7,003
Total income	102,643	128,884
Surplus after charges	30,407	60,213
Eight months' gross	3,365,897	3,024,588
Net after taxes	1,192,508	1,112,155
Other income	29,863	44,641
Total income	1,222,371	1,156,797
Surplus after charges	644,485	620,701

REPUBLIC RAILWAY & LIGHT.

The Republic Railway & Light Company reports earning for July, 1912, and the twelve months ended July 31, 1912, as follows:

	1912	1911
July gross	$ 225,072	$ 208,652
Net, after taxes	88,804	82,039
Surplus after charges	45,829	37,614
Twelve months gross	2,513,678	2,313,946
Net, after taxes	1,002,020	927,506
Surplus after charges	473,185	408,527

Earnings of the Pennsylvania Power Company are included in both years, from March 1 only, the date in 1912 as of which the securities of this company were acquired.

THIRD AVENUE.

The Third Avenue Railroad Company reports to the New York Public Service Commission for the quarter ended March 31, 1912, compared as follows:

	1912	*1911
Gross	$910,318	$841,261
Net	472,186	424,210
Surplus after charges	184,143	259,698

*In 1911 road was operated by receiver; surplus shown is before deducting interest permanently defaulted.

NEW YORK RAILWAYS COMPANY.

New York Railways Company reports for July and seven months as follows:

	May, 1912	Jan. 1-July 31
Gross	$1,150,986	$7,486,658
Net after taxes	381,102	2,462,347
Other income	35,166	229,335
Total income	416,507	2,691,682
Int. on underlying bnds	225,448	1,561,261
Int. on refunding 4s	54,331	380,313
Total interest	279,777	2,177,723
Balance	136,729	513,956

PROPOSALS.

SINGLE-CONDUCTOR CABLE.—Bids will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until October 22 for furnishing 11,480 feet of single-conductor cable to be delivered at the Navy Yard, Newport, R. I., as per Schedule 4857.

MISCELLANEOUS ELECTRICAL SUPPLIES.—Sealed proposals in triplicate will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until December 25 for furnishing miscellaneous electrical supplies, as per Canal Circular 731-A.

ELECTRIC PASSENGER ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until October 17 for an electric passenger elevator for the post office and courthouse at Wilmington, Del., in accordance with drawing and specification, copy of which may be obtained from the Supervising Architect.

ELECTRICAL APPARATUS.—Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until October 11 for furnishing electrical apparatus, including 275 horsepower motors, one 30-000-volt oil circuit breaker, three 30,000-volt single-phase expansion fuses, two automatic controllers, etc. For further information address O. H. Ensign, consulting engineer.

ELECTRIC LIGHTING MATERIAL.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until October 15 for furnishing panel boards, reflectors, outlet boxes, receptacles and portable lamps, as per Canal Circular 732. Blanks and general information may be obtained from the General Purchasing Officer or from any of the assistant purchasing agents in the large cities.

ELECTRIC CONDUITS AND WIRING AND INTERIOR LIGHTING FIXURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until October 30 for electric conduit and wiring and interior lighting fixtures of a three-story building for the post office at Vicksburg, Miss., and until November 4 of a three-story building for the post office at McCook, Neb. Drawings and specifications may be obtained from the office of the Supervising Architect.

PERSONAL MENTION.

R. S. IREMONGER, of the Harrison Lamp Works of the General Electric Company, is spending several days in Chicago in consultation with the company's representatives here.

J. P. STOKES and R. McDERMET, graduates of the University of Illinois and electrical engineering in the class of 1912, have been appointed research fellows in the engineering experiment station of that university.

J. J. CANFIELD, superintendent of the St. Paul Street Railway Company, has been appointed to succeed Leonard S. Cairns of Minneapolis, who has resigned as superintendent of the Twin City Rapid Transit Company.

GUY E. TRIPP, chairman of the Westinghouse Electric & Manufacturing Company, VICE-PRESIDENT OSBORNE and COMPTROLLER BENNETT are on a trip to Europe to visit the foreign properties of their company.

THEODORE A. BURGEN, of the firm of Lockwood, Greene & Company, architects and engineers of Boston, has opened an office in the First National Bank Building, Chicago, and will look after the firm's business in the Chicago territory hereafter.

THOMAS ESLINGER, Toledo, O., has resigned his position as division superintendent of the Toledo Railways & Light Company to become superintendent of the Rockford & Interurban Railway Company, Rockford, Ill. WILLIAM CONDON, who has been a night dispatcher for the Toledo company will succeed Mr. Eslinger with that company.

JOHN F. GRIFFIN, for eleven years connected with the Chicago Mica Company, of Valparaiso, Ind., has been appointed secretary and treasurer of that company, succeeding E. H. Heilstedt who resigned recently. Mr. Griffin is well versed in the mica business and will doubtless be successful in the management of the affairs of the company.

FLOYD N. DULL, Detroit, Mich., who has been secretary and purchasing agent for the Home Telephone Company for several years, will shortly become general manager for the Valley Telephone Company properties, which are located at Saginaw, Bay City and several other smaller towns. Mr. Dull will have a splendid opportunity in his new field to make use of his extensive experience in the telephone business.

F. C. LORING, formerly with the Metropolitan Street Railway Company, New York City, has been appointed instructor in electrical engineering in the University of Illinois. Mr. Loring is a graduate of Purdue University and of Columbia University. He was instructor in Cornell University from 1907 to 1909 and was afterwards employed by the Interboro Rapid Transit Company in New York and the municipal electric lighting plant at Marion, Ind.

J. R. BIDDINGS, assistant to Bion J. Arnold, traction expert, Chicago, Ill., is scheduled to begin work on remodeling and improving the street car service of the Pacific Gas & Electric Company in Sacramento and adjoining cities. It is planned to give the people of this section the best service that modern equipment can afford, and it was for this reason that Mr. Arnold was engaged by the street car company to make a report. The firm of B. J. Arnold has also been employed by the city of San Francisco to recommend improvements.

NEW PUBLICATIONS.

CHRISTMAS WITH THE EDISON COMPANY OF BOSTON.—The Edison Electric Illuminating Company of Boston has issued, for private distribution, a handsomely printed and illustrated pamphlet descriptive of the entertainment arranged by the company for its employees and their families on December 27, 1911, in celebration of the Christmas holiday. Mechanic's Building, Boston, with a floor space of 95,000 square feet, was secured, about 3,000 persons being present.

PUBLICITY ENGINEERING.—Walter B. Snow, publicity engineer, 170 Summer Street, Boston, Mass., has published a very interesting booklet entitled "Publicity Engineering." This booklet analyzes the development of a new type of specialist or publicity engineer, competent through his professional education and experience to deal understandingly with the engineering aspects of the work of his clients. This book should be of value to manufacturers of power machinery and engineers in connection with the laying out of publicity campaigns.

ELECRIC WIRE AND CABLE TERMINOLOGY.—Circular 37, of the Bureau of Standards, contains precise definitions in the field of conductor terminology. Seventeen of the most important terms have been defined. "Strand" implies a component part of a cable or stranded conductor, each part being either a combination of wires or a single wire. This is in accord with the non-technical meaning of "strand." A "cable" is defined as either : (1) a stranded conductor composed of a group of wires; or (2) a combination of conductors insulated from one another. The first kind of cable may be either bare or insulated. The component conductors of the second kind of cable may be either solid or stranded and the whole may or may not have a common insulating covering.

BOSTON EDISON LIFE.—The September issue of *Edison Life*, published by the Edison Electric Illuminating Company of Boston, Mass., commemorates the twenty-fifth anniversary of Charles L. Edgar's association with the company. In September of 1887, Mr. Edgar was sent to Boston by the parent Edison Company of New York and given the position of general superintendent of the Edison Electric Illuminating Company of Boston. Two years later he was made general manager and was elected to the vice-presidency early in the nineties. He filled the position of vice-president and general manager until 1900, when on the death of Jacob Rogers he was elected president of the company, which position he holds at this time. The September issue contains some very interesting information relating to the development of the company under the direction of Mr. Edgar. In 1887, the capitalization was $500,000. This has been increased to $15,603,700 today. In 1887 the connected load was 439 kilowatts; today the connected load is 152,446 kilowatts. The growth in other directions has been of the same order, and the issue is replete with interesting matter of this nature.

COMMONWEALTH EDISON HANDBOOKS.—The Commonwealth Edison Company, Chicago, Ill., has printed as a supplement to the *Edison Round Table* for July and August, a copy of the address by Samuel Insull, president of the company, on the occasion of the twenty-fifth anniversary of the Chicago Edison Company, now the Commonwealth Edison Company. The anniversary was celebrated at Orchestra Hall on Thursday evening, April 29, 1912, when Mr. Insull delivered a striking address entitled "Twenty-Five Years of Central-Station Development in Chicago." This is one of the most interesting documents that has come to hand for a long time. In addition to the highly interesting story of the development there are numerous illustrations embellishing the discussion which add greatly to the value of the presentation. The company has also issued a second edition of its "Employes' Handbook." This is certainly an inspiring publication and should be read by those in charge of every public-service company in the country. There is here published a straightforward exposition of the policy of the company in its relations with the public, the policy of the company towards its employees, and we cannot conceive of any employee reading this without being inspired with the greatest degree of loyalty and esteem for the management.

DATES AHEAD.

The 1912 Boston Electric Show, Mechanics' Building, Boston, Mass., September 28 to October 26.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Pfister, Milwaukee, Wis., September 30-October 5.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill., October 7-11.

Electric Vehicle Association. Annual convention, Boston, Mass., October 8, 9.

Railway Signal Association. Annual meeting, Quebec, Can., October 8-11.

The New York Electrical Exposition and Automobile Show. The New Grand Central Palace, New York City, October 9-19.

Sons of Jove. Annual convention, Pittsburgh, Pa., October 14-16.

New England Section of the National Electric Light Association. Fall meeting, Boston, Mass., October 15-17.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

Association of Railway Electrical Engineers. Annual convention, Chicago, Ill., October 21-24.

Illinois State Electrical Association. Annual convention, Peoria, Ill., October 22-24.

Old Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps. Annual convention, Jacksonville, Fla., October 22-24.

Indiana Electric Light Association. Annual convention, Indianapolis, Ind., October 30 and 31.

Electrical Supply Jobbers' Association, Hot Springs, Va., November 13-15.

Association of Telephone Pioneers of America. Annual convention, New York City, November 14-15.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Akron, O., November 21-22.

American Mining Congress. Fifteenth annual meeting, Spokane, Wash., November 25-28.

With the Electrical Manufacturers

Pacific Electric Heating Company. Ontario, Cal., has changed its name to **Hotpoint Electric Heating Company.** The idea in this change is to more closely identify the company with its well known "Hotpoint" heating devices and also to drop the more local name "Pacific."

Leonard-Bundy Electric Company, Cleveland, O., has issued Bulletin C, describing its battery-charging rheostats of the multiple-unit type. These are made in a variety of forms to suit various conditions of voltage and current. The bulletin also describes storage-battery charging panels and complete garage equipment.

Western Electric Company reports that its business for August, like that of July, was three per cent greater than that of the corresponding month of a year ago. The total for the eight months of the current year is also about three per cent ahead of the same period last year. On September 1 the total of unfilled orders on hand was $10,000,000, an increase of 25 per cent over the orders booked on January 1.

Electric Manufacturing Company, 940 Lafayette Street, New Orleans, La., has issued a catalog of its electrical manufactures. This is a large 60-page book dealing with panelboards, cabinets, service boxes, switchboards, electric signs, theater equipments, knife switches, electric incubators, hovers, brooders, etc. The catalog illustrates this various equipment and gives full data with dimensions and prices. Among the miscellaneous equipment manufactured is a group of electrical devices of great value in poultry raising.

General Electric Company, Schenectady, N. Y., has designed and standardized switchboard panels which long experience and accurate knowledge of requirements have demonstrated will successfully meet the demands for which they are intended. In this connection the company has just issued two new bulletins, one illustrating and describing alternating-current switchboard panels for three-phase, three-wire circuits of 240, 480 and 600 volts, 25 to 60 cycles, and the other describing direct-current switchboard of double polarity, 125, 250 and 600 volts. These bulletins are numbered 4996 and 4995, respectively.

The Sterling Machine Company, Norwich, Conn., has issued Bulletin No. 107, describing its model "B" Sterling sight-feed oil pump. This equipment provides a positive sight feed with every feed or pumping unit. Each complete unit has two plungers drawing the oil from the reservoir and forcing it through the sight feed, whence it is pumped to the point of discharge by the secondary or high-pressure plunger. The bulletin describes the equipment in considerable detail.

The Bryant Electric Company and the **Perkins Electric Switch Manufacturing Company,** Bridgeport, Conn., have just issued a new catalog of the very numerous wiring devices manufactured by both these companies. This catalog has 128 pages copiously illustrated throughout. Among the great variety of devices are the "New-Wrinkle" sockets, standard receptacles, waterproof sockets and receptacles, miniature and candelabra sockets and receptacles, attachment plugs, flush receptacles, flush switches, flush combination, service snap switches, pull and pendent switches, knife switches, rosettes, cutouts, fuses and miscellaneous accessories and devices.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued descriptive leaflet No. 2480 which gives rules for the selection of machine-tool motors and gives some valuable information relative to this subject, together with several application views. Descriptive leaflet No. 3516 also covers machine-tool motor applications giving ratings and class of motors which are suitable for the various types of machine tools. This information is put in serviceable form. A diagram is also given which shows the relation between the cutting speed in feet per minute and the area of cut in square inches, also the cubic inches of cut per minute.

The Pettingell-Andrews Company, Boston, Mass., reports business conditions excellent, with a marked increase in the demand for current-consuming devices. The entire establishment is undergoing extensive alterations in order to better serve the company's large and growing trade. Additional floor space has been secured, and a very extensive and handsomely fitted-up finished-fixture studio is being installed. The space on the main floor made vacant by the removal of the fixture studios to their new location on the second floor will be utilized for the installation of a big display room for the exhibition of electrical equipment which makes a special appeal to the consumer.

Nelite Works, General Electric Company, Cleveland, O., has issued two highly interesting new publications. Bulletin No. 103 is devoted to Holophane-D'Olier steel reflectors. This 32-page bulletin describes the very large number of types of steel reflectors that have been developed by the Nelite engineers, who have taken the stand that the large number of special lighting conditions met in any considerable plant calls for a wide variety of equipment; therefore, there have been developed lines consisting of over 500 distinct sizes, types and finishes of metal reflectors. These are of two general classes, those having aluminized interior finish and those with porcelain enamel finish. The former have been found to give complete satisfaction in every place except where excessive moisture, grime or acid fumes are present, and under such conditions the enamel finish is used.—Catalog No. 54 dealing with inner and outer Noblac globes for arc lamps has just been issued. In this 48-page book there are shown sectional diagrams of 71 types of globes designed to fit every type of commercial arc lamp. Each of these globes is subjected to a severe test, and those globes whose edges are not perfect are rejected. These Nelite bulletins will be sent to anyone on request.

Record of Electrical Patents.

Issued by the United States Patent Office, September 17, 1912.

1,038,567. Electrical Switch. M. D. Greengard, New York, N. Y. A canopy switch operated by a pendent rod.

1,038,592. Magneto. C. E. Johnson, Los Angeles, Cal., assignor of one-half to C. E. Payne. Has auxiliary pole pieces co-operating with the armature to periodically break the primary circuit.

1,038,594. Burglar-Alarm System. M. F. Juruick, New York, N. Y., assignor to Electric Bank Protection Co. The alarm bell has a mechanical hammer released by the opening of a closed circuit and an electric hammer operated on the closing of an open circuit.

1,038,598. Valve Mechanism for Automobile Engines and the Like. O. E. Kellum, Los Angeles, Cal. Has an electromagnet controlling the valve stem.

1,038,604. Process of Electric Welding. L. S. Lachman, assignor to Universal Electric Welding Co., Long Island City, N. Y. Welding pieces are placed along the joint, then current and pressure applied.

1,038,605. Composite System. O. T. Lademan, assignor to Railway Telephone & Electric Co., Chicago, Ill. A combined telephone and telegraph system has low-capacity condensers bridged around the keys and high-capacity condensers around the relays.

1,038,610. Electromagnet. D. L. Lindquist, assignor to Otis Elevator Co., Jersey City, N. J. The magnet is mounted on one side of the board and an adjustable armature on the other side.

1,038,613. Metal-Filament Incandescent Lamp. G. Ludecke, assignor to

Wolfram Lampen Aktien-Gesellschaft, Augsburg, Germany. The anchoring bridge for the filament is flexibly supported.

1,038,614. Electric Melting Furnace. W. D. Ludwick, assignor of 51 hundredths to H. Hewitt, Jr., Tacoma, Wash. Has a number of rotating hearths, each with a set of electrodes.

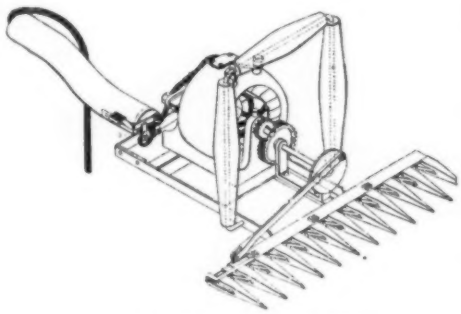
1,038,615. Electric Vehicle. R. Macrae, Chicago, Ill. Has an electric motor for each front wheel so that steering can be done mechanically or electrically; the body and rear wheels are those of an ordinary wagon.

1,038,617. Telephone Exchange System. R. H. Manson, assignor to Dean Electric Co., Elyria, O. The ringing circuit is connected to line on the connection of the cord and trunk circuits.

1,038,625. Ventilating Device. F. P. Mies, Chicago, Ill. Has separate electric heaters for the air and the humidifying device.

1,038,631. Apparatus for Sterilizing Liquids by Means of Ultraviolet Rays. A. Neveu, assignor to Société Anonyme Francaise Dite, Paris, France. The liquid is revolved so fast as to form

1,039,011.—Current Interrupter.



1,039,021.—Hedge Trimmer.

a central depression therein, into which the quartz lamp extends.

1,038,655. Coin Selector. G. C. Reith and G. F. Flade, assignors to E. F. Henson, Philadelphia, Pa. Includes an electrical mechanism depending for its operation on the differences in thickness of the coins.

1,038,659. Electric Metering Apparatus. F. W. Roller, East Orange, N. J. Has a motor element actuated by the current to be measured.

1,038,663. Door Lock. G. Sahmer, Strassburg, Germany. Has an electromagnet governing the lock bar.

1,038,681. Incandescent Electric Lamp. E. H. Tate, Los Angeles, Cal. A double-filament turn-down lamp with a pull-chain switch in its base.

1,038,701. Spark Plug. W. S. Witter, Julesburg, Colo. One electrode is longitudinally movable by means of an electromagnet.

1,038,728. Target-Practice Apparatus. H. H. Cummings, assignor to Atlantic National Bank, Providence, R. I. Includes electrical recording means.

1,038,775. Induction Motor. B. McCollum, Washington, D. C. Has a short-circuiting device for the squirrel-cage rotor, including an element whose resistance suddenly increases at a critical current value.

1,038,776. Plunger Switch. E. S. McLarn, assignor to Western Electric Co., Chicago, Ill. For use in a telephone key.

1,038,795. Annunciator. L. L. Simpson, Seattle, Wash. Has electromagnetically operated levers governing display cards.

1,038,832. Railway Telephone. D. D. Biggers, May, Okla. Relates to means for connecting the car (while running) to the line conductor and ground.

1,038,850. Fire-Extinguisher. A. A. Charbonneau and L. A. Charbonneau, Montreal, Canada. Casings contain a fire-extinguishing material which is liberated by the electric ignition of an explosive.

1,038,861. Alternating-Current Commutator Dynamo-Electric Machine. W. Doinikoff, Karlsruhe, Germany. Has a special arrangement to prevent brush sparking in a single-phase machine.

1,038,899. Display Apparatus. K. Koike, assignor to K. Takahashi, Seattle, Wash. An incandescent lamp illuminates a set of slides moved by a motor-driven slide carrier.

1,038,902. Electric Rat Trap. M. Kruczynski, Elyria, O. Beneath trap doors are sets of contacts of the electrocuting circuit.

1,038,910. Relay for Undulatory Currents. R. von Lieben and E. Reisz, Vienna, Austria-Hungary, assignors of one-third to S. Strauss. A vacuum bulb contains a cathode, an anode and a grid-like auxiliary electrode.

1,038,922. Recording and Indicating the Working of Hydraulic and Electric Lifts or Hoists. H. A. Matear, T. F. Kenney and H. Woodhouse, Liverpool, England. The recording paper is intermittently moved lengthwise.

1,038,940. Combined Switch and Tap-off. W. J. Newton, Lynbrook, N. Y., assignor to Metropolitan Electric Manufacturing Co. Has a separate tap-off that can be inserted through the cover into engagement with certain contacts on the wall plug switch.

1,038,963. Cover for Electric Switch Boxes. H. B. Roe, Pittsburgh, Pa. An adjustable sliding sleeve fits into the flanged opening of the cover.

1,038,990. Switch for Alternating-Current Machines. F. W. Trefry, Pittsburgh, Pa. A rotatable drum switch for an elevator motor.

1,038,995. Electric Switch. A. F. Wallbillich, assignor to Perkins Electric Switch Manufacturing Co., Bridgeport, Conn. Relates to details of the rotating spindle of a snap switch.

1,038,997. Telephone System. H. G. Webster, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Provides special relays for controlling the connection of the ringing circuit.

1,039,011. Current Interrupter. E. S. Beck, Treichlers, Pa. Has a copper anode, a magnetized iron cathode and means for cooling the same.

1,039,019. Electric Mail Carrier. S. A. Brandt, Tremont, Ill. Includes a conveyor with an operative connection to the mail box.

1,039,021. Hedge-Trimming Machine. E. T. Bullock, Ridley Park, Pa., assignor of one-third to E. W. Twaddell. Is driven by an electric motor.

1,039,034. Method of Manufacturing Electrodes. R. W. Davis, Jr., assignor to Pennsylvania Salt Manufacturing Co., Wyandotte, Mich. Iron or steel is heated in a hydrogen-fired furnace so as to produce a layer of magnetic oxide of iron.

1,039,039. Push Button. W. B. Eichholtz, New Orleans, La. Has a two-part receptacle with the spiral spring in one part and the reciprocating contact-closer in the other.

1,039,071. Method of Manufacturing Metallic-Oxide Electrodes. R. W. Davis, Jr., assignor to Pennsylvania Salt Manufacturing Co., Philadelphia, Pa. A modification of No. 1,039,034.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 24, 1912.

546,666. Means for Varying Light for Incandescent Electric Lamps. C. A. Hussey, New York, N. Y.

546,674. Electric Time Switch. J. F. McLaughlin, Philadelphia, Pa.

546,689. Electric Arc Lamp. C. Weber, F. Goelner and A. Schweitzer, Allegheny, Pa.

546,691. Continuous-Current Rectilinear Motor. C. E. Woods, Chicago, Ill.

546,700. Means for Analytically Recording Gait of Horses. T. J. Kean, Philadelphia, Pa.

546,724. Electric System. M. J. Wightman, Johnstown, Pa.

546,725. Self-Action Commutator for Telephones. S. Berditschewsky, D. Apstoloff and M. Freudenberg, Paris, France.

546,731. Telephone System. W. W. Dean, St. Louis, Mo.

546,739. Method of Making Porous Plates or Electrodes. J. Johnson, and J. H. Robertson, Brooklyn, N. Y.

546,799. Electric-Light Display System. J. E. Woodbridge, Duluth, Minn.

546,802. Screening Electrical or other Instruments and Apparatus. W. E. Ayrton and T. Mather, London, Eng.

546,806. Frequency Changer. E. J. Berg, Schenectady, N. Y.

546,820 and 546,821. Electric Switch. G. E. Linton, Worcester, Mass.

546,826, 546,827 and 546,828. Electric-Arc Lamp. R. Schefbauer, Paterson, N. J.

546,834. Electromagnet for Pipe Organs. E. S. Votey, Detroit, Mich.

546,837. Insulating Support for Electric Wires. J. N. Buckley, Ridgway, Pa.

546,874. Electrical Indicating System for Annunciators. W. F. Banks, Milford, Conn.

546,892. Telegraphic Vibrator. P. La Cour, Askovshus, Denmark.

546,901. Attachment for Electric Generators. G. W. Pickett, Denver, Colo.

546,904. Combined District Telegraph and Telephone System. E. E. Salisbury and A. E. Dean, Tacoma, Wash.

546,917. Electric Meter. J. A. Dejardin, Paris, France.

546,965. Telephone. G. A. Tower, M. Hunter and J. P. Eastwood, Richmond, Va.

546,966. Electrical System of Motor Regulation. M. J. Wightman, Johnstown, Pa.

546,972. Telephone Attachment. L. J. Gerson, Philadelphia, Pa.